

## Appendix A

### A Guide for Species Selection

Managing trees in a changing climate is challenging for arborists and urban foresters. Species that are currently thriving could decline as future climatic conditions alter weather events and patterns. Local knowledge and expertise of Cleveland's urban forest was utilized to produce the following guide for the selection of trees that can tolerate extreme environmental conditions.

Trees were selected and compiled into a recommended species list for Cleveland's urban forest by Holden Arboretum's Plant Collection and Records Curators. This list is intended to aid species selection for public and private land across the community with consideration given to trees that tolerate urban conditions like compaction, drought, pollution, and salt.

Specific characteristics were considered in selecting species that could collectively contribute to a more sustainable urban and community forest, including the promotion of diversity, selective use of native plants, maximization of benefits, and improvement of overall population resiliency. Ultimately, all species should be matched to the prospective site after a detailed assessment of the above- and below-ground landscape is performed and considered.

#### Tree Planting Guidelines

All future tree plantings should fall within specific guidelines outlined below and according to industry standards, such as ANSI A300.6-2014 *Planting and Transplanting* standards and ANSI Z60.1-2014-American Standards for Nursery Stock. The following tree planting guidelines help emphasize important concepts in urban and community forestry management and planning.

- **Right Tree Right Place.** Improperly siting trees can result in economic, environmental, and social losses to the community. The “*right tree right place*” maxim is central to changing the conversation around trees, specifically with respect to thinking of trees as assets versus liabilities (Arbor Day Foundation). Tree planting and transplanting projects should carefully consider plant characteristics at maturity, above- and below-ground site factors, and urban forest composition.

A unique tool is also available to assess the urban site index (USI) developed by regional urban foresters at the Ohio Department of Natural Resources Division of Forestry (Leibowitz 2012). The tool utilizes a rapid assessment of factors to score sites between 0 and 20 as a means to identify planting suitability. A long-term commitment to USI could provide an opportunity to quantify planting site suitability and track urban tree growth, longevity, and performance over time.

- **Diversity.** As a general rule of thumb, no more than 30% of any family, 20% of any genus, or 10% of any species should comprise the collective urban forest (Santamour 1990). The same diversity guidelines should apply to individual reforestation or planting and transplanting projects.

Many pests and diseases leave genera susceptible to infestation and damage as opposed to the overall tree family (Ball et al. 2007). Proposed tree plantings should, at a minimum, consider limiting the number of trees within a single genus to less than 10% per planting. Ambitious projects may aspire to meet more rigorous guidelines of planting no more than 15% of any family, 10% of any genus, or 5% of any species.

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Diversity should also be promoted within fine scale street segments to ensure large contiguous losses of canopy does not occur (ODNR 2013). A master planting plan can aid in urban forest diversity.

Native species should be prioritized where possible and practical for biodiversity as the site allows. Known invasive trees and trees likely not native to the region should be avoided. If a tree is scientifically deemed invasive in the 25-75 year urban forest management cycle, then the trees should not be planted.

- **Evergreen Conifers and Ecosystem Services.** Many of the benefits attributed to urban trees in the United States and Canada are derived from broadleaf deciduous species (Klapp 2014); these benefits are lost during leaf-off periods. Therefore, a concerted effort should be made to account for and ensure canopy-dependent benefits. For example, year-round stormwater mitigation

and pollution reduction benefits can be increased via inclusion of evergreen conifers. To sustain benefits and improve diversity, all planting projects should include at least 5% conifers that retain their foliage.

- **Growing Space Potential, Volume, and Size.** Potential planting sites are defined as areas suitable for tree planting within the existing right-of-way. The size of the site should be designated as small, medium, or large, depending primarily on the growing space available and the presence of overhead wires. The overall landscape and existing planting scheme should also be taken into consideration for the spacing and sizes of recommended planting sites.

Ensuring that a tree reaches its full size potential depends on the amount of available soil volume and surrounding site constraints. Minimum soil volumes for root space are suggested to be 1–2 ft<sup>3</sup> for each square foot of projected mature crown (Lindsey and Bassuk 1991). Other formulas have derived minimum soil volumes based on trunk to crown diameter (Urban 2008). Urban foresters generally adhere to the following soil volume minimums: 300 cubic feet for small trees, 600 cubic feet for medium trees, and 1,000 cubic feet for large trees.

Planting site width is critical to calculating available soil volume; a site's capacity influences the size of trees selected. Small trees require minimum widths of 4–6 feet, medium trees 6–8 feet, and large trees 8 feet or greater. Spacing depends on the size of adjacent or projected tree canopy diameters and should be no less than half of the projected crown. Each prospective planting site will vary in its tree-carrying capacity.

- **Limitations and Moratoriums.** Urban forest canopy has been lost from mortality associated with pests, diseases, and structurally weak tree species. Limitations and moratoriums should be considered to limit future loss due to susceptibility:
  - **Ash** – Trees in the *Fraxinus* genus should not be planted due to the confirmed presence of emerald ash borer (*Agrilus planipennis*) within the community.
  - **Elm** – Trees in the *Ulmus* genus that do not have Dutch elm disease (*Ophiostoma ulmi*; *Ophiostoma novo-ulmi*) resistance should not be planted within the community.
  - **Maple** – Trees in the *Acer* genus are susceptible to Asian longhorned beetle (*Anoplophora glabripennis*) and are currently in excess of the 20% genus rule. Planting of maple should be limited within the community. Planting of Norway maple (*Acer platanoides*) should also be limited as it currently exceeds the 10% species rule.
  - **Oak** – Planting of trees in the red oak group of the *Quercus* genus should be limited due to the presence of oak wilt (*Ceratocystis fagacearum*) within the community.
  - **Pear** – *Pyrus calleryana* is a non-native and invasive tree with weak branch and wood structure; it should not be planted in the community.
- **Utilities.** Planting medium or large trees underneath overhead utilities is a potentially costly mistake. Only small trees less than 25 feet tall at maturity should be planted underneath utility lines to limit the potential for future conflicts as trees mature in size (Ohio Consumers’ Council 2012). There may be situations where overhead utility lines are constructed at greater heights, but only qualified arborists should investigate those instances for planting.
 

The location of below-ground utilities is equally concerning to overhead utilities. The presence of buried electrical, natural gas, and water lines can limit the viability of planting sites. Detection of these utilities can be accomplished by dialing 811 for Ohio Utilities Protection Services (OUPS) at least 48 hours in advance of underground site assessment and planting.
- **Infrastructure Conflicts.** Green and grey infrastructure conflicts are common occurrences. Such conflicts are usually caused by siting large-growing species in spaces that are unsuitable for their mature size or not considering existing infrastructure in the site selection and planting process.

Trees should always be sited away from existing infrastructure at these minimum distances:

- **Street Intersections** – at least 35 feet
- **Utilities (poles, water boxes, street lamps, etc.)** – 10 to 15 feet
- **Alleys** – 15 feet
- **Driveway and Walkway Intersections** – 10 to 15 feet
- **Fire Hydrants** – 10 to 15 feet

When trees are given adequate space, less conflicts arise, management costs are reduced, and access to municipal amenities is more efficient.

## Characteristics and Scenarios

Planning, planting, and maximizing the benefits of the urban forest requires careful consideration of the following: characteristics of tree selection; realistic scenarios to create equitable distribution of canopy; and identifying specific community goals. Cleveland's urban and community forest can function at optimum levels through the maximization of proper tree selection, installation, and continued care and focus towards ensuring a sustainable future.

### Tree Characteristics

The following recommended species list for Cleveland's urban forest was compiled to address limiting factors in urban forest management and planning. With an understanding of species characteristics, trees can be selected to flourish in a wide range of scenarios. Tree characteristics should be considered only after a detailed site assessment has been performed.

- **Diversity** – over 70 species and cultivars of trees were selected to promote diversity; there has not been a recent inventory to assess the diversity of public and private trees.
- **Invasiveness** – non-native invasive tree species like *Ailanthus altissima* (tree-of-heaven) colonize vacant lots, displace native trees, and fragment forests; these types of trees were not included.
- **Hardiness** – increased temperatures from urban heat island effect and challenging microclimates; large buildings were considered in selecting trees that are tolerant of extreme climatic conditions.
- **Disease and Pest Resistance** – the presence of lethal pests and diseases was considered in excluding certain genera/species of trees and selecting specific varieties (e.g., no ash trees; emerald ash borer).
- **Mature Size and Form** – since urban environments are often limited in growspace, species and varieties were selected to provide options when existing tree canopy and infrastructure are present or could potentially obstruct growth.
- **Longevity** – trees are often short-lived in urban environments due to poor species selection, lack of care, and challenging growing conditions; all species are intended to last at least 25 years.
- **Aesthetics** – the functional shape and beauty (bark, flowers, foliage, and fruit) associated with specific species of trees was highlighted, as Cleveland has a rich horticultural legacy of curating plants.

**Native** – The majority of plants in Cleveland’s urban forest are likely not native to the region, however, native plants can be appropriate as the quality of the site allows.

- **Messiness** – Fruit can clutter the landscape, but notorious species (i.e., ginkgo, Kentucky coffeetree, persimmon) have fruitless varieties or can be sited away from infrastructure and traffic.
- **Notes** – Local knowledge and expertise and unique plant needs or considerations were highlighted to ensure proper use within Cleveland.

### *Common Planting Scenarios*

Planting in the urban forest typically involves three different planting scenarios: street trees, park trees, and private trees. A site inspection presents opportunities to identify important species selection considerations and space out and plan where future trees can be planted. Scenarios provide valuable perspective on existing processes and potential limiting factors. The following recommended species list for Cleveland’s urban forest should be utilized when selecting species for any planting project.

- **Street Trees.** A ‘street tree’ is defined as a tree growing within the public rights-of-way (generally the area between a curb and a sidewalk) which has been planted by the city or its residents. If you want to plant a street tree in Cleveland, there are a series of steps that should be taken. First and foremost, you should request a tree from the Division of Park Maintenance and Properties. Tree planting should be coordinated with the Urban Forestry Section by dialing 216-664-3104 to obtain Priority Planting status on the city’s database. A tree can be installed by the city through this process.

All other street tree plantings require a permit, which can be acquired by dialing 216-664-2388 for procurement. The

Urban Forestry section’s urban forester will then inspect the site, select an appropriate tree species, and acquire insurance from the planting contractor. Plantings are typically completed by contractors who are required to abide by the city’s tree planting details and specification.

- **Park Trees.** A ‘park tree’ may have different definitions depending on the type of park, the managing agency, and the desired goals and objectives. In general, many parks were created from open areas that were originally forestland. Some exceptions may be applied for historically conserved areas. In Cleveland, park trees fall under the management of the Division of Park Maintenance and Properties with oversight from the Urban Forestry Section’s urban forester. All tree plantings within the park require a process in which the Urban Forestry section’s urban forester can inspect, select, and oversee the process. All planting is based on the availability of funding.
- **Private Trees.** The majority of urban tree canopy is located on private lands across the community. Land uses may include: residential, multi-family residential, commercial/industrial, cemeteries, golf courses, agricultural, vacant, institutional, utility, wetlands, transportation, and other mixed or independent uses. Trees may be planted in specific land uses with a performance goal in mind. For example, riparian corridors may be planted with trees to improve stream flow. Medical campuses may utilize trees to improve human health. Industrial districts may plant to improve air quality and mitigate climate change. Also, high-density, mixed-use districts with a large amount of impervious cover may find innovative ways to site trees in an effort to offset urban heat island effect.

The most important part of identifying scenarios for planting is the careful consideration of environmental conditions and

cultural constraints (site factors) in tandem with economic and cultural factors (Miller 1997). It is important to examine the landscape and assess the soil, climatic, physiographic, and biological variables of a prospective planting site. The surrounding constraints (utilities, structures, land cover, and pollution) may limit species selection while informing best arboricultural and urban forest management practices around tree selection and planting.

Please note that planting of trees is based on availability. Most of the following cultivars may not be widely available:

### Climature Resilient Trees for Cleveland

#### Street/Tree Lawn

##### Small: Under 25'

Genus	Species
<i>Acer buergerianum</i>	trident maple
<i>Quercus prinoides</i>	dwarf chinkapin oak (super lime and drought tolerant)
<i>Styphnolobium japonicum</i>	'Pendulum' weeping Japanese pagodatree
<i>Syringa reticulata</i>	Ivory Silk' Japanese tree lilac
<i>Tilia cordata</i>	Summer Sprite, littleleaf linden
<i>Zelkova serrata</i>	City Sprite, Japanese zelkova

##### Medium: 26–50'

Genus	Species
<i>Acer campestre</i>	hedge maple ('Queen Elizabeth' not fully hardy in Zone 5)
<i>Acer miyabei</i>	'Morton' State Street Miyabe maple
<i>Carpinus betulus</i>	Emerald Avenue, European hornbeam
<i>Celtis laevigata</i>	sugar hackberry
<i>Celtis</i>	'Magnifica' hackberry hybrid
<i>Koelreuteria paniculata</i>	goldenrain tree

##### Medium (Continued)

Genus	Species
<i>Maackia amurensis</i>	'MaacNificent' Amur maackia
<i>Maackia amurensis</i>	'Starburst' Amur maackia
<i>Maclura pomifera</i>	'White Shield', Osage orange
<i>Parrotia persica</i>	'Vanessa' Persian ironwood
<i>Quercus robur x bicolor</i>	'Nadler' Kindred Spirit oak
<i>Ulmus parvifolia</i>	Allee lacebark elm
<i>Ulmus propinqua</i>	Emerald Sunshine elm
<i>Zelkova serrata</i>	'Mushashino' columnar Japanese zelkova
<i>Zelkova serrata</i>	'Village Green' Japanese zelkova

##### Large: Over 50'

Genus	Species
<i>Acer x freemanii</i>	'Autumn Blaze' Freeman maple
<i>Betula nigra</i>	river birch - tree form, single stem
<i>Ginkgo biloba</i>	ginkgo (male clones)
<i>Gleditsia triacanthos var. inermis</i>	honeylocust [Imperial, 'Shademaster', Skyline, StreetKeeper]
<i>Gymnocladus dioica</i>	Kentucky coffeetree - male clones [Espresso, Prairie Titan, Stately Manor]
<i>Ostrya virginiana</i>	hophornbeam
<i>Platanus x acerifolia</i>	'Exclamation' London planetree
<i>Quercus bicolor</i>	swamp white oak
<i>Quercus imbricaria</i>	shingle oak
<i>Quercus macrocarpa</i>	bur oak
<i>Quercus muehlenbergii</i>	chinkapin oak
<i>Quercus palustris</i>	pin oak
<i>Quercus palustris</i>	Green Pillar columnar pin oak

##### Large (Continued)

Genus	Species
<i>Quercus robur</i> x <i>bicolor</i> 'Long'	Regal Prince oak
<i>Quercus rubra</i>	red oak
<i>Quercus shumardii</i>	Shumard oak
<i>Styphnolobium japonicum</i> 'Regent'	Japanese pagodatree
<i>Taxodium distichum</i>	baldcypress
<i>Tilia</i> x <i>euchlora</i>	Crimean Linden
<i>Tilia cordata</i>	Greenspire, littleleaf linden
<i>Tilia tomentosa</i>	silver linden
<i>Ulmus americana</i>	American elm cultivars. 'Princeton', 'Jefferson', 'New Harmony'
<i>Ulmus</i> 'Patriot'	elm hybrid
<i>Ulmus</i> 'Triumph'	elm hybrid
<i>Zelkova serrata</i> 'Green Vase'	Japanese zelkova

**Deciduous Trees for Parks and Other Larger Plots  
Including Private Land**

***Small: Under 25'***

Genus	Species
<i>Acer buergerianum</i>	trident maple
<i>Aesculus pavia</i>	red buckeye
<i>Asimina triloba</i>	pawpaw
<i>Cercis canadensis</i>	redbud
<i>Chionanthus retusus</i>	Asian fringetree
<i>Cornus florida</i> 'Appalachian Spring'	flowering dogwood
<i>Cornus kousa</i>	Asian flowering dogwood
<i>Magnolia</i> 'Golden Gift'	yellow magnolia
<i>Magnolia</i> x <i>loebneri</i>	loebner magnolia
<i>Magnolia stellata</i>	star magnolia

***Small (Continued)***

Genus	Species
<i>Magnolia virginiana</i>	sweetbay magnolia
<i>Malus</i> 'Bob White'	flowering crab apple
<i>Malus</i> 'Prairifire'	flowering crab apple
<i>Malus</i> 'Red Jewel'	flowering crab apple
<i>Malus</i> 'Sugar Tyme'	flowering crab apple
<i>Syringa reticulata</i> 'Ivory Silk'	Japanese tree lilac
<i>Tilia cordata</i> 'Summer Sprite'	littleleaf linden
<i>Zelkova serrata</i> 'City Sprite'	Japanese zelkova

***Medium: 26-50'***

Genus	Species
<i>Acer campestre</i>	(Avoid Queen Elizabeth: not reliably winter hardy in Zone 5)
<i>Acer griseum</i>	paperbark maple
<i>Acer miyabei</i> 'Morton'	State Street Miyabe maple
<i>Acer triflorum</i>	threeflower maple
<i>Aesculus glabra</i>	Ohio buckeye
<i>Amelanchier</i> x <i>grandiflora</i>	apple serviceberry
<i>Amelanchier laevis</i>	Allegheny serviceberry
<i>Carpinus betulus</i> 'Emerald Avenue'	European hornbeam
<i>Carpinus caroliniana</i>	American hornbeam
<i>Celtis laevigata</i>	sugar hackberry
<i>Celtis</i> 'Magnifica'	hackberry hybrid
<i>Cladrastis kentukea</i>	yellowwood
<i>Crataegus viridis</i> 'Winter King'	green hawthorn
<i>Halesia tetraptera</i>	Carolina silverbell
<i>Koelreuteria paniculata</i>	goldenrain tree
<i>Maackia amurensis</i> 'MaacNificent'	Amur maackia
<i>Maackia amurensis</i> 'Starburst'	Amur maackia
<i>Maclura pomifera</i> 'White Shield'	Osage orange

**Medium (Continued)**

Genus	Species
<i>Magnolia</i> ‘Butterflies’	yellow magnolia
<i>Magnolia</i> ‘Coral Lake’	magnolia
<i>Magnolia</i> ‘Daybreak’	magnolia
<i>Magnolia</i> ‘Elizabeth’	yellow magnolia
<i>Magnolia tripetala</i>	umbrella magnolia
<i>Magnolia</i> ‘Yellow Bird’	yellow magnolia
<i>Parrotia persica</i>	Persian ironwood
<i>Quercus robur</i> x <i>bicolor</i> ‘Nadler’	Kindred Spirit oak
<i>Ulmus</i> ‘Frontier’	elm hybrid
<i>Ulmus parvifolia</i> Allee	lacebark elm
<i>Ulmus propinqua</i> ‘Emerald Sunshine’	elm
<i>Zelkova serrata</i> ‘Mushashino’	columnar Japanese zelkova
<i>Zelkova serrata</i> ‘Village Green’	Japanese zelkova

**Large: Over 50’**

Genus	Species
<i>Acer</i> x <i>freemanii</i> ‘Autumn Blaze’	Freeman maple
<i>Aesculus flava</i>	yellow buckeye
<i>Betula nigra</i>	river birch - tree form, single stem
<i>Cercidiphyllum japonicum</i>	katsuratree
<i>Diospyros virginiana</i>	common persimmon
<i>Fagus sylvatica</i>	European beech
<i>Ginkgo biloba</i>	ginkgo (male clones)
<i>Gleditsia triacanthos</i> var. <i>inermis</i>	honeylocust [Imperial, ‘Shademaster’, Skyline, StreetKeeper]
<i>Gymnocladus dioica</i>	Kentucky coffeetree
<i>Liriodendron tulipifera</i>	tuliptree
<i>Liquidambar styraciflua</i>	sweetgum [‘Moraine’, ‘Variegata’, plants of Ohio provenance]

**Large (Continued)**

Genus	Species
<i>Magnolia acuminata</i>	cucumber tree
<i>Metasequoia glyptostroboides</i>	dawn redwood
<i>Nyssa sylvatica</i>	black gum
<i>Ostrya virginiana</i>	hophornbeam
<i>Platanus</i> x <i>acerifolia</i> ‘Exclamation’	London planetree
<i>Quercus bicolor</i>	swamp white oak
<i>Quercus imbricaria</i>	shingle oak
<i>Quercus macrocarpa</i>	bur oak
<i>Quercus muehlenbergii</i>	chinkapin oak
<i>Quercus palustris</i>	pin oak
<i>Quercus palustris</i>	Green Pillar, columnar pin oak
<i>Quercus robur</i> x <i>bicolor</i> ‘Long’	Regal Prince oak
<i>Quercus rubra</i>	red oak
<i>Quercus shumardii</i>	Shumard oak
<i>Styphnolobium japonicum</i> ‘Regent’	Japanese pagodatree
<i>Taxodium distichum</i>	bald cypress
<i>Tilia</i> x <i>euchlora</i>	Crimean Linden
<i>Tilia americana</i>	American linden
<i>Tilia cordata</i> ‘Greenspire’	littleleaf linden
<i>Tilia tomentosa</i>	silver linden
<i>Ulmus americana</i>	American elm cultivars. ‘Princeton’, ‘Jefferson’, ‘New Harmony’
<i>Ulmus</i> ‘Patriot’	elm hybrid
<i>Ulmus</i> Triumph	elm hybrid
<i>Zelkova serrata</i> ‘Green Vase’	Japanese zelkova



**Evergreen Trees for Parks and Other Larger Plots  
Including Private Land**

***Small: Under 25'***

Genus	Species
<i>Juniperus chinensis</i>	'Keteleeri'
	Chinese juniper (average to dry sites)

***Medium: 26-50'***

Genus	Species
<i>Juniperus virginiana</i>	('Canaertii', 'CorCorCor' Emerald Sentinel), eastern redcedar (average to dry sites)
<i>Pinus virginiana</i>	Virginia pine (average to dry sites)
<i>Thuja occidentalis</i>	Eastern arborvitae (upright types)
<i>Thuja</i>	'Green Giant' a.k.a. 'Spring Grove'
	arborvitae hybrid

***Large: Over 50'***

Genus	Species
<i>Abies concolor</i>	white fir
<i>Abies nordmanniana</i>	Nordman fir
<i>Picea orientalis</i>	oriental spruce
<i>Pinus rigida</i>	pitch pine
<i>Pinus rigida</i> × <i>taeda</i>	pitch-lob pine

\*Compiled by Charles Tubesing, Curator of Plant Collections, The Holden Arboretum, with input on conifers from Ethan Johnson, Plant Records Curator.

## Species Selection Matrix

Species <sup>1</sup>	Common Name	Cultivars	Size <sup>2</sup>	Spread	Form	Hardiness Zone	Growth Rate	Longevity	Aesthetics	Native <sup>3</sup>	Scenario	Performance <sup>4</sup>	Notes
<i>Abies concolor</i>	white fir	***	L	20'	conical	3 to 7	slow	50 > years	***	***	park or private	AQ	conifer; protected sites
<i>Abies nordmanniana</i>	Nordman fir	***	L	30'	pyramidal	4 to 6	slow	50 > years	***	***	park or private	AQ	conifer
<i>Acer buergerianum</i>	trident maple	***	S	25'	oval	5 to 8	slow	50 > years	***	***	park, private or street	***	overhead-utility line compatible
<i>Acer campestre</i>	hedge maple	***	M	30'	rounded	5 to 8	slow	50 > years	***	***	park, private or street	***	Queen Elizabeth not fully hardy in Zone 5
<i>Acer griseum</i>	paperbark maple	***	M	20'	rounded	5 to 7	slow	50 > years	bark	***	park	***	***
<i>Acer miyabei</i>	Miyabe maple	Morton	M	25'	upright oval	4 to 6	slow	50 > years	***	***	park, private or street	***	
<i>Acer triflorum</i>	threeflower maple	***	M	30'	upright spreading	5 to 7	slow	50 > years	bark	***	park	***	***
<i>Acer x freemanii</i>	Freeman maple	Autumn Blaze	L	40'	broad oval	4 to 7	fast	25-50 years	foliage	Ohio	park, private or street	CC,H,S,UHI	dominant central leader
<i>Aesculus flava</i>	yellow buckeye	***	L	50'	upright oval	4 to 8	moderate	50 > years	***	Ohio	park	CC,H,S,UHI	requires a sheltered site
<i>Aesculus glabra</i>	Ohio buckeye	***	M	40'	rounded	3 to 7	moderate	50 > years	***	Cuyahoga County	park	CC,H,S,UHI	shade tolerant
<i>Aesculus pavia</i>	red buckeye	***	S	20'	rounded (varies)	4 to 8	moderate	50 > years	flowers	Ohio	park	***	red flower
<i>Amelanchier laevis</i>	Allegheny serviceberry	***	M	40'	rounded	4 to 8	moderate	50 > years	flowers	Ohio	park	AQ	prefers shade
<i>Amelanchier x grandiflora</i>	apple serviceberry	***	M	30'	rounded	5 to 8	moderate	50 > years	fruit	North America	park	AQ	prefers shade
<i>Asimina triloba</i>	paw-paw	***	S	20'	pyramidal (multi-stem)	5 to 9	moderate	25-50 years	fruit	Cuyahoga County	park	AQ	***
<i>Betula nigra</i>	river birch	***	L	50'	pyramidal (rounded)	4 to 9	fast	25-50 years	bark	Cuyahoga County	park, private or street	***	tree form, single stem
<i>Carpinus betulus</i>	European hornbeam	Emerald Avenue	M	30'	pyramidal (oval-rounded)	4 to 7	moderate	50 > years	***	***	park, private or street	***	***
<i>Carpinus caroliniana</i>	American hornbeam	***	M	30	round (irregular)	3 to 9	slow	50 > years	***	Cuyahoga County	park	***	***
<i>Celtis laevigata</i>	sugarberry	***	M	50'	broad-rounded	5 to 9	moderate	50 > years	bark	North America	park, private or street	CC,H,UHI	***
<i>Celtis x</i>	hybrid hackberry	Magnifica	M	40'	broad-oval	5 to 9	fast	50 > years	***	North America	park, private or street	CC,H,UHI	***
<i>Cercidiphyllum japonicum</i>	katsuratree	***	L	50'	pyramidal (oval-rounded)	4 to 8	moderate	25-50 years	***	***	park or private	AQ	moist and protected sites
<i>Cercis canadensis</i>	redbud	***	S	25	flat-topped (rounded)	4 to 9	moderate	25-50 years	flowers	Ohio	park or private	***	lime tolerant; well drained sites
<i>Chionanthus retusus</i>	Chinese fringetree	***	S	20'	broad-rounded	4 to 9	slow	25-50 years	fruit	***	park or private	***	***
<i>Cladrastis kentuckea</i>	Kentucky yellowwood	***	M	40'	broad-rounded	4 to 8	moderate	25-50 years	***	Ohio	park or private	***	attention to structural pruning
<i>Cornus florida</i>	flowering dogwood	Appalachian Spring	M	20'	flat-topped (rounded)	5 to 9	slow	25-50 years	flowers	Cuyahoga County	park or private	***	Appalachian Spring anthracnose resistant
<i>Cornus kousa</i>	Asian flowering dogwood	***	M	30'	rounded (horizontal)	5 to 8	slow	25-50 years	fruit	***	park or private	***	***

Species <sup>1</sup>	Common Name	Cultivars	Size <sup>2</sup>	Spread	Form	Hardiness Zone	Growth Rate	Longevity	Aesthetics	Native <sup>3</sup>	Scenario	Performance <sup>4</sup>	Notes
<i>Crataegus viridis</i>	green hawthorn	Winter King	M	25'	vase (spreading)	4 to 7	slow	25-50 years	fruit	North America	park or private	***	Winter King thornless
<i>Diospyros virginiana</i>	common persimmon	***	L	35'	pyramidal (oval-rounded)	4 to 9	moderate	25-50 years	***	Ohio	park or private	AQ	not widely available; plant where fruit is not an issue
<i>Fagus sylvatica</i>	European beech	***	L	50'	pyramidal (rounded)	5 to 7	moderate	50 > years	***	***	park or private	CC	***
<i>Ginkgo biloba</i>	ginkgo	see notes	L	40'	pyramidal (wide-spread)	4 to 7	slow	50 > years	***	***	park, private or street	CC,H,S	male clones
<i>Gleditsia triacanthos var. inermis</i>	honeylocust	Imperial	L	40'	broad-spreading	4 to 7	fast	25-50 years	***	Cuyahoga County	park, private or street	***	***
		'Shademaker'	L	40'	upright-spreading	4 to 7	fast	25-50 years	***	Cuyahoga County	park, private or street	***	***
		Skyline	L	35'	pyramidal-spreading	4 to 7	fast	25-50 years	***	Cuyahoga County	park, private or street	***	***
		StreetKeeper	L	20'	broad-columnar	4 to 7	fast	25-50 years	***	Cuyahoga County	park, private or street	***	***
<i>Gymnocladus dioica</i>	Kentucky coffeetree	Espresso	L	35'	vase (irregular)	4 to 8	slow	50 > years	***	Ohio	park, private or street	***	
		Prairie Titan	L	45'	oval (irregular)	4 to 8	slow	50 > years	***	Ohio	park, private or street	***	male clones
		Stately Manor	L	40'	obovate (irregular)	4 to 8	slow	50 > years	***	Ohio	park, private or street	***	
<i>Halesia tetraptera</i>	Carolina silverbell	***	M	30'	round headed	5 to 8	moderate	50 > years	flowers	Ohio	park or private	***	white flower
<i>Juniperus chinensis</i>	Chinese juniper	Keteleeri	S	15'	pyramidal	3 to 9	moderate	25-50 years	foliage	***	park or private	***	average to dry sites; conifer
<i>Juniperus virginiana</i>	eastern redcedar	'Canaertii'	M	20'	dense-pyramidal	4 to 9	moderate	25-50 years	***	Ohio	park or private	***	average to dry sites; conifer
		Emerald Sentinel	M	10'	pyramidal column	4 to 9	moderate	25-50 years	***	Ohio	park or private	***	average to dry sites; conifer; good fruiting form
<i>Koelreuteria paniculata</i>	goldenrain tree	***	M	30'	rounded	5 to 8	moderate	25-50 years	flowers	***	park, private or street	***	heat tolerant
<i>Liquidambar styraciflua</i>	sweetgum	'Moraine'	L	40'	pyramidal	5 to 9	fast	25-50 years	foliage	Ohio	park or private	CC,H,S,UHI	***
		'Variegata'	L	35'	pyramidal	5 to 9	moderate	25-50 years	foliage	Ohio	park or private	CC,H,S,UHI	variegated
<i>Liriodendron tulipifera</i>	tuliptree	***	L	40'	pyramidal (rounded)	4 to 9	fast	50 > years	***	Cuyahoga County	park or private	CC,H,S,UHI	***
<i>Maackia amurensis</i>	amur maackia	MaacNificent	M	25'	upright vase	4 to 7	slow	25-50 years	bark	***	park, private or street	***	***
		'Starburst'	M	20'	vase (rounded)	4 to 7	slow	25-50 years	bark	***	park, private or street	***	***
<i>Maclura pomifera</i>	osage orange	'White Shield'	M	35'	rounded	4 to 9	fast	25-50 years	***	Cuyahoga County	park, private or street	***	fruitless; thornless
<i>Magnolia acuminata</i>	cucumber tree	***	L	40'	pyramidal (rounded)	4 to 8	moderate	50 > years	fruit	Cuyahoga County	park or private	CC,H,S,UHI	***

Species <sup>1</sup>	Common Name	Cultivars	Size <sup>2</sup>	Spread	Form	Hardiness Zone	Growth Rate	Longevity	Aesthetics	Native <sup>3</sup>	Scenario	Performance <sup>4</sup>	Notes
<i>Magnolia</i> spp.	magnolia	'Butterflies'	M	10'	upright pyramidal	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	shelter from wind; yellow flower
		'Coral Lake'	M	20'	upright pyramidal	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	coral flower; shelter from wind
		'Daybreak'	M	20'	upright pyramidal	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	pink flower; shelter from wind
		'Elizabeth'	M	20'	upright pyramidal	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	shelter from wind; yellow flower
		'Golden Gift'	S	5'	compact	5 to 7	moderate	25-50 years	flowers	•••	park or private	•••	shelter from wind; yellow flower
		'Yellow Bird'	M	20'	upright pyramidal	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	shelter from wind; yellow flower
<i>Magnolia stellata</i>	star magnolia	•••	S	15'	dense-rounded	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	pink and white flower; heat and cold tolerance
<i>Magnolia tripetala</i>	umbrella magnolia	•••	M	15'	pyramidal	4 to 8	moderate	25-50 years	flowers	Ohio	park or private	H	•••
<i>Magnolia virginiana</i>	sweetbay magnolia	•••	S	20'	oval (rounded)	5 to 9	moderate	25-50 years	flowers	North America	park or private	•••	fragrant flowers
<i>Magnolia x loebneri</i>	Loebner magnolia	•••	S	15'	rounded (dense)	5 to 8	moderate	25-50 years	flowers	•••	park or private	•••	pink or white fragrant flower
<i>Magnolia stellata</i>	star magnolia	•••	S	15'	dense-rounded	4 to 8	moderate	25-50 years	flowers	•••	park or private	•••	pink and white flower; heat and cold tolerance
<i>Magnolia tripetala</i>	umbrella magnolia	•••	M	15'	pyramidal	4 to 8	moderate	25-50 years	flowers	Ohio	park or private	H	•••
<i>Magnolia virginiana</i>	sweetbay magnolia	•••	S	20'	oval (rounded)	5 to 9	moderate	25-50 years	flowers	North America	park or private	•••	fragrant flowers
<i>Magnolia x loebneri</i>	Loebner magnolia	•••	S	15'	rounded (dense)	5 to 8	moderate	25-50 years	flowers	•••	park or private	•••	pink or white fragrant flower
<i>Malus</i> spp.	crab apple	Bob White	S	20'	dense-rounded	4 to 7	moderate	25-50 years	flowers	•••	park or private	•••	white flower
		Prairiefire	S	20'	dense-rounded	4 to 7	moderate	25-50 years	flowers	•••	park or private	•••	fuchsia flower
		Red Jewel	S	15'	dense-rounded	4 to 7	moderate	25-50 years	fruit	•••	park or private	•••	red fruit
		Sugar Tyme	S	15'	dense-rounded	4 to 7	moderate	25-50 years	fruit	•••	park or private	•••	red fruit
<i>Metasequoia glyptostroboides</i>	dawn redwood	•••	L	25'	pyramidal (conical)	5 to 8	fast	50 > years	bark	•••	park or private	CC,H,S,UHI	best near water source; riparian
<i>Nyssa sylvatica</i>	blackgum	•••	L	30'	pyramidal	4 to 9	moderate	50 > years	foliage	Cuyahoga County	park or private	•••	fall color
<i>Ostrya virginiana</i>	American hop-hornbeam	•••	L	30'	rounded (horizontal)	4 to 9	slow	50 > years	fruit	Cuyahoga County	park, private or street	CC,UHI	•••
<i>Parrotia persica</i>	Persian ironwood	'Vanessa'	M	15'	pyramidal	4 to 8	moderate	25-50 years	bark	•••	park, private or street	•••	•••
<i>Picea orientalis</i>	oriental spruce	•••	L	20'	pyramidal	4 to 7	slow	50 > years	•••	•••	park or private	•••	conifer
<i>Pinus rigida</i>	pitch pine	•••	L	40'	pyramidal (irregular)	4 to 7	moderate	50 > years	•••	Ohio	park or private	•••	conifer; well drained
<i>Pinus rigida x taeda</i>	pich-lob pine	•••	L	40'	pyramidal	4 to 7	fast	50 > years	•••	North America	park or private	•••	conifer
<i>Pinus virginiana</i>	Virginia pine	•••	M	30'	broad (pyramidal)	4 to 8	slow	25-50 years	•••	Ohio	park or private	•••	average to dry sites; conifer

Species <sup>1</sup>	Common Name	Cultivars	Size <sup>2</sup>	Spread	Form	Hardiness Zone	Growth Rate	Longevity	Aesthetics	Native <sup>3</sup>	Scenario	Performance <sup>4</sup>	Notes
<i>Platanus x acerifolia</i>	London planetree	Exclamation	L	40'	upright-pyramidal	4 to 8	moderate	50 > years	bark	...	park, private or street	CC,H,S	cold hardy
<i>Quercus bicolor</i>	swamp white oak	...	L	50'	broad rounded	3 to 8	moderate	50 > years	...	Cuyahoga County	park, private or street	...	soil adaptability
<i>Quercus imbricaria</i>	shingle oak	...	L	60'	broad rounded	4 to 7	slow	50 > years	...	Cuyahoga County	park, private or street	...	...
<i>Quercus macrocarpa</i>	bur oak	...	L	70'	broad rounded	2 to 8	slow	50 > years	...	Cuyahoga County	park, private or street	...	drought and lime tolerant
<i>Quercus muehlenbergii</i>	chinkapin oak	...	L	40'	rounded	4 to 7	moderate	50 > years	...	Cuyahoga County	park, private or street	...	drought and lime tolerant
<i>Quercus palustris</i>	pin oak	...	L	40'	pyramidal	4 to 7	fast	50 > years	...	Cuyahoga County	park, private or street	CC	lime intolerant
		Green Pillar	L	15'	narrow-columnar	4 to 7	fast	50 > years	...	Cuyahoga County	park, private or street	CC	
<i>Quercus prinoides</i>	dwarf chinkapin oak	...	S	10'	pyramidal	4 to 8	slow	25-50 years	...	North America	street	...	lime and drought tolerant; overhead-utility line compatible
<i>Quercus robur x bicolor</i>	hybrid English oak	'Nadler' Kindred Spirit Oak	M	10'	narrow-columnar	3 to 7	slow	25-50 years	...	...	park, private or street	...	...
		'Long' Regal Prince Oak	L	20'	narrow-columnar	4	slow	25-50 years	...	...	park, private or street	...	...
<i>Quercus rubra</i>	red oak	...	L	60'	rounded	4 to 7	fast	50 > years	...	Cuyahoga County	park, private or street	...	...
<i>Quercus shumardii</i>	Shumard oak	...	L	50'	rounded	5 to 9	moderate	25-50 years	...	Ohio	park, private or street	CC,H,S,UHI	soil adaptability
<i>Styphnolobium japonicum (Sophora japonica)</i>	Japanese pagodatree	'Regent'	L	40'	oval (rounded)	4 to 7	fast	25-50 years	...	...	park, private or street	...	...
		'Pendulum'	S	15'	weeping	4 to 7	fast	25-50 years	...	...	street	...	overhead-utility line compatible
<i>Syringa reticulata</i>	Japanese tree lilac	'Ivory Silk'	S	20'	rounded	3 to 7	moderate	25-50 years	flowers	...	park, private or street	...	overhead-utility line compatible
<i>Taxodium distichum</i>	bald cypress	...	L	25	pyramidal	4 to 9	moderate	50 > years	bark	Ohio	park, private or street	H,S	...
<i>Thuja occidentalis</i>	eastern arborvitae	many exist	L	15'	pyramidal	2 to 7	slow	50 > years	...	Ohio	park or private	...	upright types; conifer
<i>Thuja x</i>	hybrid arborvitae	'Green Giant' or 'Spring Grove'	L	20'	broad-pyramidal	4 to 7	slow	50 > years	...	...	park or private	...	conifer
<i>Tilia americana</i>	American linden	...	L	40'	oval rounded (arched)	2 to 8	moderate	50 > years	...	Cuyahoga County	park or private	CC,H,S,UHI	low urban tolerance
<i>Tilia cordata</i>	littleleaf linden	Greenspire	L	30'	oval-rounded	4	moderate	50 > years	...	...	park, private or street	CC,H,S,UHI	...
		Summer Sprite	S	15'	rounded	4	moderate	50 > years	...	...	street	CC,H,S,UHI	overhead-utility line compatible
<i>Tilia tomentosa</i>	silver linden	...	L	40'	pyramidal (oval-egg)	2 to 6	moderate	50 > years	...	...	park, private or street	CC,H,S,UHI	...
<i>Tilia x euchlora</i>	Crimean linden	...	L	25'	rounded	3 to 7	moderate	25-50 years	...	...	park, private or street	H	...

Species <sup>1</sup>	Common Name	Cultivars	Size <sup>2</sup>	Spread	Form	Hardiness Zone	Growth Rate	Longevity	Aesthetics	Native <sup>3</sup>	Scenario	Performance <sup>4</sup>	Notes
<i>Ulmus americana</i>	American elm	'Princeton'	L	50'	vase (spreading)	4	moderate	50 > years	...	Cuyahoga County	park, private or street	CC,H,S,UHI	...
		'Jefferson'	L	50'	vase (arching)	4	moderate	50 > years	...	Cuyahoga County	park, private or street	CC,H,S,UHI	...
		'New Harmony'	L	65'	vase (arching)	4	moderate	50 > years	...	Cuyahoga County	park, private or street	CC,H,S,UHI	...
<i>Ulmus parvifolia</i>	Chinese elm	Allee	M	30'	vase (upright-rounded)	5 to 9	moderate	25-50 years	bark	...	park, private or street	...	...
<i>Ulmus propinqua</i>	emerald sunshine elm	Emerald Sunshine	M	25'	vase (pyramidal)	5	fast	25-50 years	...	...	park, private or street	...	...
<i>Ulmus x</i>	hybrid elm	'Frontier'	M	30'	vase (oval)	5	fast	25-50 years	foliage	...	park or private	...	...
		'Patriot'	L	40'	vase (upright-narrow)	4	fast	50 > years	...	...	park, private or street	...	...
		'Triumph'	L	45'	vase (upright-oval)	4	fast	50 > years	...	...	park, private or street	...	...
<i>Zelkova serrata</i>	Japanese zelkova	'City Sprite'	S	20'	vase (compact)	5	moderate	50 > years	...	...	street	CC,H,S,UHI	overhead-utility line compatible
		'Green Vase'	L	30'	vase (spreading)	5 to 8	moderate	50 > years	...	...	street	CC,H,S,UHI	...
		'Mushashino'	L	15'	narrow (upright)	5 to 8	moderate	50 > years	...	...	park, private or street	CC,H,S,UHI	...
		'Village Green'	L	40'	vase (rounded)	5 to 8	moderate	50 > years	...	...	park, private or street	CC,H,S,UHI	...
<i>Ulmus americana</i>	American elm	'Princeton'	L	50'	vase (spreading)	4	moderate	50 > years	...	Cuyahoga County	park, private or street	CC,H,S,UHI	...
		'Jefferson'	L	50'	vase (arching)	4	moderate	50 > years	...	Cuyahoga County	park, private or street	CC,H,S,UHI	...
		'New Harmony'	L	65'	vase (arching)	4	moderate	50 > years	...	Cuyahoga County	park, private or street	CC,H,S,UHI	...
<i>Ulmus parvifolia</i>	Chinese elm	Allee	M	30'	vase (upright-rounded)	5 to 9	moderate	25-50 years	bark	...	park, private or street	...	...

<sup>1</sup> Developed by Charles Tubering and Ethan Johnson with edits from Chad Clink \*Reference Dirr's Encyclopedia of Trees and Woody Plants; Dirr's Manual of Woody Plants; The Practical Science of Planting Trees and Shrubs. Check for local availability.

<sup>2</sup> Small trees >25', Medium trees 25-50', Large trees >50'

<sup>3</sup> The Woody Plants of Ohio, E. Lucy Brown (cultivars are not considered native)

<sup>4</sup> H = Health; S = Stormwater; AQ = Air Quality; UHI = Urban Heat Island; CC = Climate Change