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## Ecological Considerations and Application of Urban Tree Selection in Massachusetts

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**Ecological Considerations and Application of Urban Tree Selection in Massachusetts**

A Thesis Presented

by

ASHLEY M. MCELHINNEY

Submitted to the Graduate School of the  
University of Massachusetts Amherst in partial fulfillment  
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Environmental Conservation

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## ABSTRACT

### ECOLOGICAL CONSIDERATIONS AND APPLICATION OF URBAN TREE SELECTION IN MASSACHUSETTS

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Trees provide countless environmental, economic, and societal benefits to the urban environment, and may become increasingly important to maintaining environmental quality and human well-being in the face of increasing urbanization and climate change. However, trees in these urban areas are rapidly diminishing across the United States. Much of this loss can be prevented with proper planning and management, focused on selecting tree species that are both well-suited to the area's growing conditions and able to survive the many stress factors in an urban setting. Choosing which tree species to plant in Massachusetts is especially challenging considering the lack of resources specific to the state's growing conditions and the urban environment. I conduct a literature review to answer two research questions: (1) What ecological considerations should be made before tree selection, and (2) Which species should be planted in the urban environments of Massachusetts. My results yielded a comprehensive guide, in book form, detailing the five ecological considerations I recommend to make before selection, and profiles of 75 tree species recommended to plant in these areas. This book may act as a resource for tree wardens and homeowners to help choose the best species for their specific planting site, prompt other states to create or update their own state-specific selection guide, and encourage tree nurseries to grow and distribute favorable species, ultimately providing their communities with the countless benefits that trees provide.

## TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
LIST OF TABLES.....	v
CHAPTER	
1. INTRODUCTION.....	1
2. METHODS.....	3
2.1 Tree species.....	3
2.2 Information criteria.....	3
2.3 Limitations.....	4
2.4 Urban tree suitability.....	4
2.5 Trees and assisted migration.....	4
3. RESULTS.....	6
3.1 Ecological considerations.....	6
3.1.1 Tolerance to conditions common in urban environments.....	6
3.1.2 Current and future climate suitability.....	7
3.1.3 Area of origin.....	8
3.1.4 Management issues.....	9
3.1.5 Biodiversity.....	9
3.2 Species recommended for the urban environments of Massachusetts.....	10
APPENDICES.....	13
A. SITE ASSESSMENT.....	13
B. HOW TO USE THIS GUIDE.....	14
C. SPECIES PROFILES.....	16
BIBLIOGRAPHY.....	54

## LIST OF TABLES

Table	Page
1. Trees and assisted migration.....	11
2. Species quick guide.....	12

## CHAPTER 1

### INTRODUCTION

We've all heard it- 'right plant, right place'<sup>1</sup>. This type of proactive planning is a powerful strategy, critical to creating and maintaining a healthy urban forest. A well-placed tree has the ability to provide a number of ecological, economic, and societal benefits throughout its lifetime. Trees reduce atmospheric carbon dioxide<sup>2,3</sup>, levels of airborne pollutants, air temperature<sup>4</sup>, stormwater runoff and flooding, and provide other critical ecological services<sup>2</sup>. Trees contribute economically by boosting property values<sup>5</sup> and fostering energy savings from nearby buildings<sup>4</sup>. Within cities, trees increase people's feelings of well-being, minimize noise, and reduce crime<sup>5,2,6</sup>. Trees are a growing investment, and over time generate their benefits in greater magnitude as they increase in size and stature<sup>7</sup>.

When we hear the term 'urban forest', we tend to picture a sad, lone tree surrounded only by pavement, bustling traffic, and skyscrapers. In this guide, 'urban forest' applies to the entire developed landscape gradient, from a city's core to suburban communities, including trees on streets, public parks, and private landscapes. Tree species growing in these areas are becoming increasingly important, as more land is developed and more residents continue to move into urban settings.

These areas are not the easiest for a tree to survive; currently, the US is losing 36.2 million urban trees each year, which totals an estimated annual loss of ecosystem services to be \$96 million<sup>8</sup>. The average lifespan of a tree in downtown urban areas ranges from 19-28 years<sup>9</sup>, a significantly shorter timespan than their forested counterparts that may live for centuries. Much of this tree mortality can be prevented with proper planning and management that is focused on selecting tree species that are both well-suited to the site's growing conditions and tolerant of the many stress factors found in an urban setting.

Massachusetts is the most urbanized state in New England, with 40.4% of its land reported as "urban" in the 2010 census. This is expected to increase to 60.7% by 2060. Within the state's urban and community areas, 19.4% of land cover is impervious surface, while tree cover is roughly 45.5% - an estimated 178 million trees. These trees store 34 million metric tons of carbon (\$775.2 mil), and annually remove 1.1 million metric tons of carbon (\$25.5 mil) and 28,850 metric tons of air pollution (\$244.7 mil)<sup>10</sup>.

To make matters worse, the expected changes in climate conditions have the potential to significantly alter the biogeography of our urban forests. Extreme heat events and drought, both of which have been shown to decrease tree growth and cause tree mortality, have been forecast to increase in frequency, duration, and severity<sup>15, 16, 17</sup>. Tree growth is also affected by seasonal precipitation amount and form<sup>13</sup>, which, in Massachusetts, is predicted to decrease in summer and increase by 30% in the winter, primarily as rain<sup>18</sup>.

Therefore, I created the first tree selection guide specific to the urban environments of Massachusetts. This guide aims to act as a resource for anyone interested in planting a tree in Massachusetts – a professional, a volunteer, or a private resident. Although this should not be viewed as the final authority in a tree search, we endeavor to provide readers with the information necessary to confidently choose which species is best for their planting site, and which species best meets their planting objectives.

## CHAPTER 2

### METHODS

#### 2.1 Tree species

A comprehensive, broad-based literature review was undertaken to decide which tree species would be included in *Planting for Resilience: Selecting Urban Trees in Massachusetts*. This began by determining which trees were recommended in other selection guides produced by university extension programs, state agencies and the industry (i.e., nurseries). Once an initial list relevant to growing conditions in the Northeast was composed, characteristics and attributes of each tree (i.e., preferred environmental conditions, site adaptability, optimal growing conditions) were assessed. This information was gathered from not only the aforementioned selection guides, but tree identification books, encyclopedias, and online resources generated from various stakeholders.

Individual tree species were carefully scrutinized and eliminated based on invasive potential (i.e., *Robinia pseudoacacia*), pest susceptibility (i.e., *Fraxinus spp.*, *Sorbus spp.*), management considerations (i.e., *Pyrus calleryana*) and overall compatibility to adverse urban environments (i.e., *Acer saccharinum*, *Pinus strobus*). Tree species' sensitivity and adaptability to common stress factors found in the urban environment (i.e., alkaline soil, drought, heat, salt, pollution, poorly drained soils, mechanical damage), were specifically considered; From there, current and future habitat suitability was analyzed in an attempt to ensure that remaining tree species would be well-adapted to future climate projections of the Northeast (see Methods 2.5). The profile pages for these species can be seen in Appendix A.

#### 2.2 Information criteria

Tree species data is often anecdotal, based on observations of industry professionals, agency/university specialists and tree enthusiasts from the general public. Discrepancies concerning tree attributes and characteristics often occurred between reference materials. Thus, consistency and agreement among sources was an important consideration relevant to determining the information that was deemed acceptable to include. Generally, information presented in this guide has been verified by at least two other references. Though no single claim or piece of information was casually dispensed with, a hierarchy of

trust was established where isolated claims and observations in sole sources were not included in an attempt to conservatively consider discrepancies. For example, the “highest” or most conservative hardiness zone rating found in the literature for each species was listed on their profile, if it could be verified by two or more sources. This was done so that a tree would not be planted in a zone that would be too cold, beyond what it could tolerate. A range was presented regarding each tree species’ height and width, that generally included the smallest and largest values found in the literature.

### 2.3 Limitations

Urban forestry is a relatively new field of study, and unlike traditional forestry where trees have been studied and observed for many centuries, there is a dearth of data concerning the growth and response of trees in our expanding towns and cities. Climatic projections themselves also vary. Being such long-lived organisms, trees may not perform as predicted relative to their response to shifting habitat suitability, over extended periods of time.

### 2.4 Urban tree suitability

“Urban” tree species must be able to tolerate a host of difficult conditions including soils that often feature extreme pH, prolonged periods of dryness, salt, pollution, and poor drainage. Although not all species here are well-suited for tough, urban sites, I highlight species (using an icon in the top corner of its profile page) that are notably adaptable to these adverse conditions. Some references (Dirr, University of Connecticut, Cornell University) presented a list of species that were recommended to plant in tough, urban sites, which were taken into account.

### 2.5 Trees and assisted migration

The search to identify tree species predicted to perform well under climate change scenarios in Massachusetts began by analyzing the US Forest Service Climate Change Tree Atlas. This interactive tool documents the current and projected future distribution of 134 tree species in the Eastern United States. The state-specific ‘Table of Winners and Losers’ presents the modeled current Importance Value (IV)

(numerical value denoting the abundance of the species), projected difference in IVs (of two models under both high and low emissions scenarios, for a total of four projections), and model reliability for each of these species. I calculated the mean of the four projected differences in IVs and calculated the projected future IV for each species in Massachusetts (Table 1) by subtracting this value from the current IV. This future IV indicated which species would have suitable habitat in our state's projected future climate. I also included species' 'Modification Factors' (ModFacts) score. This score adds context to each species' IVs by taking into account nine biological factors and twelve disturbance factors of a species, as well as model uncertainty, in an attempt to determine how outside disturbances or biological factors might influence the future distributions of these species. For example, a species may be adaptable to rising temperatures, but highly susceptible to a specific insect or disease pest.

I included only tree species with models of one or two, for reliability. For instance, *Betula nigra*, *Gleditsia triacanthos*, and *Quercus shumardii* were projected to gain IV, but with low model reliability, thus, they were not included in the list. I then applied a second tool created by NC State University in collaboration with the US Forest Service, known as 'The ForeCASTS Project', to visually verify data gathered from the Climate Change Tree Atlas. This source applied two models, under two different emissions scenarios, to project future habitat maps for 2050 and 2100, by delineating areas that are statistically identical, similar, or less similar to locations where the species is known to currently exist. A third reference from the Northern Institute of Applied Climate Science titled, 'Climate Change Projections for Individual Tree Species in New England and Northern New York' used future IV data from Tree Atlas models, as well as from the LANDIS model, to identify how a tree species' distribution is expected to change (i.e., increase, decrease, remain relatively stable) by 2100. This information is accompanied by an adaptability score (high, medium, low) that is similar to the aforementioned ModFac score.

## CHAPTER 3

### RESULTS

#### 3.1 Ecological considerations

##### 3.1.1 Tolerance to adverse conditions common in urban environments

Urban areas can present adverse growing conditions, narrowing the list of species that may otherwise be well-suited to a site's capacity. Not only must urban trees endure the stress factors that forest trees experience, such as natural disasters, diseases, insects, drought, and competition for resources, but they must also tolerate a wide range of anthropogenic challenges. Urban environments have more impervious surfaces than rural environments<sup>11</sup>, which can inhibit root growth and limit the infiltration of moisture<sup>12, 13</sup>. With the addition of vehicular and foot traffic, urban soils are often compacted, feature poor drainage, altered nutrient composition, and contamination<sup>14</sup>. The use of de-icing salt and materials containing limestone raise the pH of most urban soils, making them unfavorably alkaline<sup>14</sup>. The elevated levels of air pollution and temperature in urban environments also create unfavorable growing conditions<sup>14</sup>.

For instance, a study comparing sugar maple (*Acer saccharum*) trees growing in a woodland area with those planted on a college campus only one mile away revealed the vast differences between the two sites' conditions. Soil moisture, air and leaf temperature, humidity, pH, and soil nutrients were all found to be less optimal on campus. Researchers theorized that these conditions likely contributed to less growth, earlier fall color, and earlier leaf drop from the campus trees<sup>14</sup>.

It is important to note that no tree species prefers adverse conditions, but some species may have a higher threshold or tolerance for them. I sought to select species with an observed tolerance to the conditions they would likely face in the urban environment. An icon featured on the applicable species' profiles is used to indicate that the species is especially adaptable to adverse environmental conditions found in the urban environment. However, this does not mean it is inherently well-suited for an urban site – the species may also possess undesirable traits that should be considered before selection, such as the tendency for branch breakage, messiness related to fruit production, or low hanging branches that require pruning for street-use.

### 3.1.2 Current and future climate suitability

Selecting a tree species that is well-suited to both the current and future climate of Massachusetts is important, as the expected changes in climate conditions may compromise the health and ultimately survival, of many species common to Massachusetts. If the aforementioned projections are accurate, these species will have to either adapt, or migrate 3,000 to 5,000 meters (1.86 to 3.1 miles) per year to avoid extinction. This far exceeds the maximum rate of 500 meters (0.31 miles) per year observed for plant species. Trees, being much more long-lived than other plant species, will have an especially challenging time, and could take many centuries to adapt to new climate conditions<sup>19</sup>. The habitat fragmentation common in urban environments exacerbates this issue by limiting species' ability to naturally migrate.

Therefore, I considered assisted migration when selecting which tree species to include. The silver lining to these altered conditions is that they can increase the habitat suitability for other tree species. The average temperature in Massachusetts is expected to increase over 7°F (13.9°C) by the end of the century<sup>20</sup>, meaning more southerly species may become more acclimated. By choosing to plant these species now, we could prevent possible extinction, minimize economic loss, maintain biodiversity, and sustain the benefits that trees provide. There are three types of assisted migration: (1) Assisted population migration: species are moved within current range; (2) Assisted range expansion: species are moved to suitable areas just outside current range; (3) Assisted species migration: species are moved far outside of current range.

Assisted population migration and assisted range expansion are both used as management strategies to keep pace with changing climate conditions, while assisted species migration is applied more as a last resort to prevent a species from becoming extinct<sup>19</sup>. I do not include assisted species migration as an option in this guide, as it assumes much more ecological and financial risk. An icon featured on the applicable species' profiles is used to indicate that the species would be either at the northern edge of, or just outside of, their current range if planted in Massachusetts, and could help to mitigate the tree loss we may see under climate change conditions.

### 3.1.3 Area of origin

I would like to emphasize the importance of planting native species where appropriate. Native species provide substantially more support to native wildlife when compared to their non-native counterparts. Using native tree species has been shown to support a 50% higher abundance of native birds, 9x higher abundance of rare birds, 3x more butterfly species, and 2x higher abundance of native bees<sup>21</sup>. Non-native plants also present greater risks when planted, as they are 40x more likely to become invasive than native plants<sup>22</sup>. Invasive plants have the potential to displace native species, reduce biodiversity, and completely restructure an ecosystem (i.e., nutrient cycling, hydrology systems, fire regime)<sup>23</sup>. The resulting habitat, often a monoculture of a plant unfamiliar to the surrounding wildlife and insects, may not provide suitable food and shelter, especially for specialist species who depend on specific plants for survival.

Mosquitoes, ticks, and other pests harmful to human health have been shown to increase in number as a result of non-native, invasive plants such as Japanese barberry (*Berberis thunbergii*) and honeysuckles (*Lonicera* spp.)<sup>23</sup>. Non-native plant imports may also act as a Trojan horse for forest pests: an estimated 70% of non-native forest pests, including hemlock woolly adelgid (*Adelges tsugae*), arrived as contaminants on these plant imports. Currently, an average of 2.5 previously unrecognized non-native insect species are established each year in the US<sup>24</sup>. Additionally, non-native plants can sustain pests and pathogens by providing previously unavailable feeding niches. Since many non-native plants are transported from warmer climates<sup>24</sup>, global warming may provide further opportunity for these species to invade. The US spends an estimated \$20 billion each year to manage and control invasive plants<sup>21</sup>; this includes not only taxpayer dollars, but homeowners who have to pay for tree removal or suffer diminished property value<sup>24</sup>. A recommended management strategy is to plant less than 30% non-native species in the landscape<sup>21</sup>.

Not all tree species recommended in this guide are native, as a hardy, well-suited non-native species can make a great addition to an urban forest. An icon featured on the applicable species' profiles is used to indicate that the species is native. In the 'Notes & Limitations' section of applicable species' profiles, the phrase "has begun to cause concern related to invasive potential - recommended to not plant near natural settings where they could invade, and to monitor" is used to notify the reader.

### 3.1.4 Management issues

Considering species' various management issues, such as pest susceptibility, may also be important before selection. Introduced to the US in the late 1990s, the Emerald ash borer (*Agrilus planipennis*) has since spread to most states, causing widespread loss and mortality among Ash trees (*Fraxinus* spp.). The destructive beetle was first detected in Massachusetts in 2012, and now resides in 42 of the state's communities, as well as most other New England states<sup>25</sup>. Ash trees are adaptable, native to Massachusetts, and make up a reported 5% of the state's street trees<sup>26</sup>, meaning that 1 in 20 of our street trees could be lost in the next few years, all from a single insect species<sup>14</sup>. Although there are various proactive management strategies being used to mitigate this pest's impact (i.e., quarantine, biological control, insecticide treatments), I have chosen to not include Ash spp. in this guide. Other species were excluded due to other concerns, such as invasive status (i.e., *Robinia pseudoacacia*), management concerns (i.e., *Pyrus calleryana*, *Acer saccharinum*), and overall incompatibility to the urban environment (i.e., *Pinus strobus*).

### 3.1.5 Biodiversity

Simultaneously, it is critical to maintain a high level of biodiversity among tree species in the urban forest. Biodiversity is essential to almost all ecosystem processes, resilience, and stability<sup>27</sup>. Considering that different tree species are susceptible to different pests, planting a variety of species can help to minimize urban forest canopy loss. The well-known depletion of urban forests across Massachusetts due to the wilt fungus *Ophiostoma novo-ulmi*, known as Dutch elm disease, exacerbated by the over-planting of the American elm (*Ulmus americana*), serves as an example of the risk associated with a monoculture<sup>28</sup>.

Since 2008, over 30,000 trees have been removed from Worcester County, MA, in efforts to eradicate the invasive Asian longhorned beetle [29]. These removals were in primarily urban residential areas, where, in Massachusetts, Maple trees (*Acer* spp.) account for approximately 49% of our street trees [26]. Although the state is making tremendous progress in replacing these trees, a 2013 study showed that a 10% loss in the area's tree canopy cover caused a .7°C increase in land surface temperature, and the resulting 10% increase in exposed impervious surface caused a 1.66°C increase in land surface temperature [29].

The “10-20-30 guideline” is commonly used to ensure an ideal level of biodiversity; this rule states that in any community, less than 10% of trees should be of the same species, less than 20% should be from the same genus, and less than 30% should be from the same family<sup>30</sup>. However, biodiversity objectives often vary from community to community. The community’s land use and characteristics, as well as the resources available for urban forest management (i.e., time, money, staff, equipment) can greatly influence the feasibility of certain goals. Some communities are striving to use a “5-10-15 guideline”.

Maintaining biodiversity can be difficult, as the adverse conditions of the urban environment greatly limits compatible tree species. Additionally, cold temperatures of Massachusetts have been shown to limit diversity; urban tree inventories conducted in warmer cities in California and Florida include more than 2x the amount of species found when compared to urban tree inventories of the northeast<sup>14</sup>. To abide by the “10-20-30 guideline”, urban foresters should consider how to match tree species with appropriate sites, and pay special attention to maintenance practices. I aimed to select a variety of species that are less commonly planted to encourage diverse plantings. In the ‘Notes & Limitations’ section of applicable species’ profiles, the phrase ‘may be over-planted’ is used to indicate that the species is commonly found in the urban forest, and a site’s surrounding biodiversity should be carefully assessed before a final selection is made.

### 3.2 Species recommended to plant in the urban environments of Massachusetts

See Appendix C.

Scientific Name	Model Reliability (1=High, 3=Low)	Current IV	Projected IV	IV Gain/ Loss	ModFac Score (1.7-8.5)
<i>Acer rubrum</i>	1	22.13	11.82	-10.31	8.5
<i>Acer saccharum</i>	1	5.0	3.76	-1.24	5.8
<i>Amelanchier spp.</i>	2	0.51	0.47	-0.04	4.8
<i>Betula nigra</i>	3	0.00	0.28	+0.28	3.7
<i>Catalpa speciosa</i>	3	0.00	0.00	0.00	4.2
<i>Carpinus caroliniana</i>	2	0.61	0.903	+0.293	5.1
<i>Celtis laevigata</i>	2	0.00	1.405	+1.405	4.6
<i>Celtis occidentalis</i>	2	0.00	1.015	+1.015	5.7
<i>Cercis canadensis</i>	2	0.00	0.64	+0.64	4.9
<i>Chamaecyparis thyoides</i>	3	0.34	0.237	-0.103	3.0
<i>Cornus florida</i>	1	0.26	2.37	+2.11	5.0
<i>Gleditsia triacanthos</i>	3	0.00	0.713	+0.713	5.5
<i>Gymnocladus dioicus</i>	3	0.00	0.00	0.00	4.3
<i>Halesia spp.</i>	2	0.00	0.00	0.00	4.2
<i>Juniperus virginiana</i>	2	0.64	3.403	+2.763	3.9
<i>Liquidambar styraciflua</i>	1	0.11	3.86	+3.75	5.3
<i>Liriodendron tulipifera</i>	1	0.19	1.613	+1.423	4.3
<i>Maclura pomifera</i>	2	0.00	0.33	+0.33	6.3
<i>Nyssa sylvatica</i>	1	0.31	1.415	+1.105	5.9
<i>Ostrya virginiana</i>	2	0.86	1.448	+0.588	6.4
<i>Quercus alba</i>	1	2.92	5.395	+2.475	6.1
<i>Quercus bicolor</i>	3	0.08	0.007	-0.073	4.9
<i>Quercus coccinea</i>	1	1.85	2.262	+0.412	4.6
<i>Quercus imbricaria</i>	2	0.00	0.343	+0.343	4.9
<i>Quercus macrocarpa</i>	2	0.00	0.37	+0.37	6.4
<i>Quercus montana</i>	1	0.70	1.665	+0.965	6.1
<i>Quercus muehlenbergii</i>	2	0.00	0.43	+0.43	4.8
<i>Quercus palustris</i>	2	0.00	0.365	+0.365	2.8
<i>Quercus phellos</i>	2	0.00	0.477	+0.477	5.4
<i>Quercus rubra</i>	1	6.33	4.14	-2.19	4.7
<i>Quercus shumardii</i>	3	0.00	0.51	+0.51	5.8
<i>Sassafras albidum</i>	1	0.58	1.758	+1.178	4.2
<i>Taxodium distichum</i>	2	0.00	0.40	+0.40	3.9
<i>Thuja occidentalis</i>	1	0.36	0.08	-0.28	4.2
<i>Tilia americana</i>	2	0.031	1.52	+1.21	4.6
<i>Ulmus americana</i>	2	1.02	2.29	+1.27	4.0

Table 1: Trees and assisted migration. Model reliability (1= most reliable, 3= least), current and projected IV, ModFac score (1.7-8.5 scale) for each species in the guide that was featured in the USDA Climate Change Tree Atlas. Highlighted species were chosen as ‘Candidates for assisted migration’.

Common Name	Scientific Name	Zone	Height (Ft)	Width (Ft)	Native	Utility Line Compatible	Notably Urban	Candidate for Assisted Migration	Page #
Trident Maple	<i>Acer buergerianum</i>	5B	20-30	15-25		✓	✓		13
Hedge Maple	<i>Acer campestre</i>	5A	25-35	25-35			✓		14
Paperbark Maple	<i>Acer griseum</i>	5A	20-30	20-30		✓			15
Miyabe Maple	<i>Acer miyabei</i>	4B	30-45	30-40					16
Red Maple	<i>Acer rubrum</i>	3B	40-60	30-70	✓		✓		17
Sugar Maple	<i>Acer sacharrum</i>	3B	60-75	35-50	✓				18
Purpleblow Maple	<i>Acer truncatum</i>	4B	25-30	25-30		✓	✓		19
Freeman Maple	<i>Acer x freemanii</i>	4A	40-75	Varies	✓				20
Red Horsechestnut	<i>Aesculus x carnea</i>	5A	30-50	30					21
Serviceberry	<i>Amelanchier spp.</i>	4A	15-25	15-30	✓	✓			22
River birch	<i>Betula nigra</i>	4A	40-70	40-60	✓				23
Common Hornbeam	<i>Carpinus betulus</i>	5A	35-60	30-40					24
American Hornbeam	<i>Carpinus caroliniana</i>	3A	20-30	20-30	✓	✓		✓	25
Northern Catalpa	<i>Catalpa speciosa</i>	4A	40-60	20-40	✓		✓		26
Sugar Hackberry	<i>Celtis laevigata</i>	5A	60-80	50	✓		✓	✓	27
Common Hackberry	<i>Celtis occidentalis</i>	3A	40-60	40-60	✓		✓	✓	28
Katsura tree	<i>Cercidiphyllum japonicum</i>	4A	40-60	25-60					29
Eastern Redbud	<i>Cercis canadensis</i>	4A	20-30	25-35	✓	✓	✓	✓	30
Atlantic White Cedar	<i>Chamaecyparis thyoides</i>	4B	40-60	10-20	✓				31
White Fringetree	<i>Chionanthus virginicus</i>	5A	15-25	10-25	✓	✓	✓		32
Yellowwood	<i>Cladrastis kentukea</i>	4A	30-50	40-55	✓				33
Japanese Clethra	<i>Clethra barbinervis</i>	5B	10-20	10-20		✓			34
Kousa Dogwood	<i>Cornus kousa</i>	5A	15-30	15-30		✓			35
Corneliancherry Dogwood	<i>Cornus mas</i>	5A	15-25	15-20		✓			36
Dogwood Hybrids	<i>Cornus x rutgersensis</i>	5A	10-20	10-20		✓		✓	37

Turkish Filbert	<i>Corylus colurna</i>	4A	40-50	15-35			✓		38
American Smoketree	<i>Cotinus obovatus</i>	4A	20-30	15-30	✓	✓	✓		39
Thornless Cocksaur	<i>Crataegus crusgalli var. inermis</i>	4A	20-30	20-35	✓	✓	✓		40
'Winter King' Hawthorn	<i>Crataegus virdis 'Winter King'</i>	4A	25	25	✓	✓	✓		41
Hardy Rubber Tree	<i>Eucommia ulmoides</i>	5A	40-60	40-60			✓		42
Ginkgo	<i>Ginkgo biloba</i>	4B	50-80	30-40			✓		43
Honeylocust	<i>Gleditsia triacanthos var. inermis</i>	4B	40-60	30-70	✓		✓		44
Kentucky Coffeetree	<i>Gymnocladus dioica</i>	3A	50-75	40-50	✓		✓		45
Carolina Silverbell	<i>Halesia carolina</i>	5A	20-40	20-35	✓				46
Witchhazel	<i>Hamamelis virginiana</i>	4A	10-30	15-20	✓	✓			47
Eastern Red Cedar	<i>Juniperus virginiana</i>	3B	40-50	8-20	✓		✓	✓	48
Goldenraintree	<i>Koelreuteria paniculata</i>	5A	30-40	30-40			✓		49
American Sweetgum	<i>Liquidambar styraciflua</i>	5B	50-75	40-65	✓			✓	50
Tuliptree	<i>Liriodendron tulipifera</i>	5A	70-90	35-50	✓			✓	51
Amur Maackia	<i>Maackia amurensis</i>	4A	20-30	20-30		✓	✓		52
Osage Orange	<i>Maclura pomifera var. inermis</i>	5B	20-50	20-50	✓		✓	✓	53
Flowering Crabapple	<i>Malus spp.</i>	4B	10-25	10-25		✓			54
Dawn Redwood	<i>Metasequoia glyptostroboides</i>	5A	70-100	25-50					55
Black Gum	<i>Nyssa sylvatica</i>	4A	30-60	20-40	✓			✓	56
Hophornbeam	<i>Ostrya virginiana</i>	4A	25-40	20-40	✓			✓	57
Persian Parrotia	<i>Parrotia persica</i>	5A	20-30	15-30		✓	✓		58
Serbian Spruce	<i>Picea omorika</i>	4B	50-60	20-25					59
Swiss Stone Pine	<i>Pinus cembra</i>	4A	30-40	15-25					60
London Planetree	<i>Platanus x acerifolia</i>	5A	70-100	65-80			✓		61
Accolade Cherry	<i>Prunus 'Accolade'</i>	5A	20-30	15-25		✓			62

White Oak	<i>Quercus alba</i>	4A	45-80	45-80	✓			✓	63
Swamp White Oak	<i>Quercus bicolor</i>	4A	45-70	45-60	✓		✓		64
Scarlet Oak	<i>Quercus coccinea</i>	5A	60-75	40-50	✓			✓	65
Shingle Oak	<i>Quercus imbricaria</i>	4A	40-60	40-65	✓			✓	66
Bur Oak	<i>Quercus macrocarpa</i>	3A	60-80	60-90	✓		✓	✓	67
Chestnut Oak	<i>Quercus montana</i>	5A	60-70	60-70	✓			✓	68
Chinkapin Oak	<i>Quercus muehlenbergii</i>	4B	35-50	35-60	✓			✓	69
Pin Oak	<i>Quercus palustris</i>	4A	50-70	25-40	✓				70
Willow Oak	<i>Quercus phellos</i>	6A	40-60	40-60	✓		✓	✓	71
English Oak	<i>Quercus robur</i>	5A	40-60	40-60			✓		72
Shumard Oak	<i>Quercus shumardii</i>	5B	40-60	45-65	✓		✓		73
Common Sassafras	<i>Sassafras albidum</i>	4B	30-60	25-40	✓			✓	74
Japanese umbrella pine	<i>Sciadopitys verticillata</i>	5B	20-30	15-20		✓			75
Japanese Pagodatree	<i>Styphnolobium japonicum</i>	5A	50-70	35-55			✓		76
Japanese Tree Lilac	<i>Syringa reticulata</i>	3A	20-30	15-25		✓	✓		77
Baldcypress	<i>Taxodium distichum</i>	5A	50-70	20-40	✓		✓	✓	78
Arborvitae	<i>Thuja occidentalis</i>	3A	40-60	10-15	✓				79
American Linden	<i>Tilia americana</i>	3A	60-80	20-40	✓			✓	80
Littleleaf Linden	<i>Tilia cordata</i>	3B	50-70	30-50					81
Silver Linden	<i>Tilia tomentosa</i>	5A	50-70	25-55					82
American Elm Cultivars	<i>Ulmus americana</i>	3B-5A	60-80	30-60	✓		✓	✓	83
Lacebark Elm	<i>Ulmus parvifolia</i>	5B	40-75	30-75			✓		84
Elms Hybrids	<i>Ulmus x spp.</i>	3B-5A	50-70	40-60			✓		85
Siebold's Viburnum	<i>Viburnum sieboldii</i>	4B	15-20	10-15		✓			86
Japanese Zelkova	<i>Zelkova serrata</i>	5A	50-80	40-60			✓		87

Table 2. Species quick guide.

# APPENDIX A

## SITE ASSESSMENT

### SITE ASSESSMENT

*Due to the high variability of site conditions in urban environments, it's critical to analyze below & above ground conditions before selecting which species to plant*

**SITE COMPATABILITY**

**1a.) USDA hardiness zone:**  
 5a    5b    6a  
 6b    7a

**2a.) Limitations to rooting space:**  
 Physical barriers or compact soil?  
 Available rooting space

**2b.) Limitations to overhead space:**  
 Wires  
 Proximity to buildings/structures

**3.) Water availability:**  
 Supplemental irrigation during establishment & drought?

**4.) Road salt & pollutants:**  
 Distance to road (Exposure & damage is highest within 25 ft)  
 Speed limit (Salt damage intensity & range increases with speed)

**5.) Biodiversity:**  
 Highest % of same tree family in area  
 Highest % of tree genus in area  
 Highest % of tree species in area

**6.) Other** (Competition from existing vegetation, energy conservation opportunities, wildlife to support, aesthetic concerns)

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MANAGEMENT CONSIDERATIONS

**SOIL CHARACTERISTICS**

**7a.) Soil pH range:**  
 pH

**7b.) Soil drainage:** Fill a 12x12" hole with water & observe drainage rate.  
 Fast (6+"/hr)  
 Moderate (1-6"/hr)  
 Slow (<1"/hr)

**7c.) Soil structure:**  
 Bulk density (Higher density= more compact)  
 Presence of earthworms? (May indicate favorable soil)  
 Indicator plants (wet, well-drained, or dry)

**7d.) Soil texture:**  
 Sandy (feels gritty)  
*drains well, resists compaction, can be nutrient poor and moisture deficient*  
 Loamy (feels both smooth & gritty)  
*drains well, retains moisture and nutrients, resists compaction*  
 Clay (feels smooth)  
*retains moisture and nutrients, prone to compaction, poor drainage*

## APPENDIX B

### HOW TO USE THIS GUIDE

#### USING THIS GUIDE

##### SCIENTIFIC & COMMON NAME

At the top of each profile is the tree's genus (i.e., *Quercus*) and specific epithet (i.e., *bicolor*), followed by the common name (i.e., Swamp white oak).

##### ENVIRONMENTAL CONDITIONS

Although all trees prefer what are almost universally considered favorable growing conditions (consistently moist, well-drained soil with a pH ranging from 6.2–6.8; adequate light and space), it is rare to find them all in the urban environment. In this section, we present species' adaptability to extreme temperatures (hardiness zones), light levels, soil pH, and soil moisture.

- **Hardiness zones:** Based on average annual extreme minimum temperatures as designated by the USDA's Plant Hardiness Zone Map; each zone differs by 10°F, and each subzone, ("a" or "b"), differs by 5°F. In Massachusetts, hardiness zones range from 5a in the Berkshire mountains to 7a on Cape Cod; most of western Massachusetts is considered zone 5b, while the eastern area of the state is mostly classified as zone 6b.

*Example:* If you're planting in zone 6b, select a species hardy to zone 6b or below (6a, 5b, 5a, etc.). Plants hardy to zone 7a and above may not be able to survive.

A landscape's microclimate may affect its hardiness zone.

*Example:* If a planting site in zone 6b is sunny and protected from the wind, it could be categorized as zone 7a. Alternatively, if a different planting site within the same landscape is in an exposed, low-lying area, it may be categorized as zone 6a.

- **Light:** Preference for full sun (>6 hrs direct light daily), partial shade (3-6 hrs direct light daily, or filtered light for most of the day), or full shade (<3 hrs direct light or <6 hrs filtered light daily) is listed.
- **Soil pH:** Adaptability to soil pH, which is often alkaline in urban environments.  $\leq 7.0$  indicates species that do not tolerate alkaline soil, and can only tolerate soils pH from 5.0-7.0.  $\leq 7.5$  indicates species that moderately tolerate alkaline soil, or pH from 5.0-7.5, and  $\leq 8.2$  indicates species that tolerate alkaline soil, or pH from 5.0-8.2.
- **Soil moisture:** Adaptability to varying levels of soil moisture, described as 'tolerant' or 'intolerant' of 'occasional periods' or 'prolonged periods' of dry and/or saturated soil. Urban sites typically do not receive adequate water, and although established trees often become acclimated to less than optimal moisture, newly transplanted trees need several years of supplemental watering. Species that can tolerate saturated soils are typically well-suited for areas prone to flooding and sites featuring poorly-drained soils.

##### CHARACTERISTICS

This section explores tree species' growth and ornamental characteristics. To account for variation and influence from a number of factors (i.e., soil moisture, light, etc.), a range is assigned for most characteristics. Growth characteristics and space requirements should usually be given higher priority than ornamental characteristics.

- **Height:** Species' height in feet at maturity. A species may grow taller in its natural setting, but the range given is its expected height in the landscape. The height of utility lines is typically 25' - 30', so an icon (seen on page 12) at the top of the page is used to indicate a potential conflict due to tree height.
- **Width:** Species' canopy width in feet at maturity. A species may grow wider in its natural setting, but the range given is its expected canopy width in the landscape.
- **Growth rate:** A species listed as 'slow' grows at a rate of <12" per year, 'medium' grows 13-24" per year, and 'fast' grows >25" per year.

- **Form:** Often includes form in both juvenile and mature stages; 'single- or multi-stemmed' is included if relevant. Form is especially important to consider for street tree selection.
- **Flower:** Species' flower shape, color, size, and/or scent at maturity, and if it is considered 'showy' or 'inconspicuous'.
- **Fruit:** Species' fruit shape, color, size, and/or scent at maturity; see 'Limitations' section for indication of potentially messy fruit.
- **Foliage:** Typically includes spring and fall color, and includes emerging leaf color description, if of interest.
- **Bark:** Appearance and texture in juvenile and mature stages. 'Ornamental' is used to describe a bark of particular interest, especially in winter with no leaf cover.

#### PLANTING CONSIDERATIONS

- **Pests:** Select insect or disease pests of importance may be listed.
- **Tolerates:** Species' observed tolerances, including drought, flooding, salt, pollution, poor drainage, shearing, and wind/storm damage. 'Shade' and 'alkaline soil' are not included in this section, as the species' tolerance for each are listed in 'Environmental Conditions'. These tolerances apply to trees that are established in the landscape, as newly transplanted trees are more vulnerable to stress. These qualities are difficult to quantify, and can be inconsistent, but should serve as a general look into how adaptable a species is to adverse conditions.
  - *Soil compaction vs. poor-drainage:* We refer to this tolerance only as 'poor-drainage', as soil compaction falls under this umbrella and other factors can cause soils to be poorly-drained. This factor is especially important to consider in areas with vehicular or foot traffic.
  - *Salt spray vs. soil salt:* Both modes of salt injury are classified as 'salt' tolerant, as they are rarely differentiated in the literature. Salt spray is damaging to plant stems and buds, while soil salt applied during the months when soil is warmer and roots are active (due to snow event on the extreme shoulders of the growing season) may also damage trees. Species with a reported tolerance may still be damaged by heavy salt applications.
- **Transplant:** The main methods of transplanting recommended here are balled and burlapped (B&B), bare root (BR), and container grown (CG). 'Easy' may indicate that a species takes less time to establish compared to 'difficult' species. The amount of time a tree takes to establish may be additionally influenced by its size: the larger the caliper at transplant, the longer it will typically take to establish. The general guideline is to allow 1 year for every inch caliper before the tree is considered established and able to grow without supplemental watering. Choosing small caliper trees when possible is typically advised, as is avoiding trees larger than 3" in caliper (Cornell University Urban Horticulture Institute).
- **Cultivars:** Several commonly available cultivated varieties may be listed. These "cultivars" may have certain tolerances that the species do not, or feature improved characteristics (i.e., ornamental foliage, specific growth form, thornless).

#### NOTES & LIMITATIONS

This section includes specific benefits, management recommendations, and any other miscellaneous information pertaining to the tree species in question. This section also includes warnings regarding potential health, growth, and management issues that should be considered before selecting the tree species in question. For instance, a species' messy fruit or tendency towards branch failure presented here indicates that it may not be the best selection for street use, but may be suitable in a park.



Native to the Eastern US



Safe to plant under or near utility lines- mature height of  $\leq 30'$



Notably adaptable to adverse conditions



Candidate for assisted migration

## APPENDIX C

### SPECIES PROFILES

# TRIDENT MAPLE

*Acer buergerianum*



#### ENVIRONMENTAL CONDITIONS

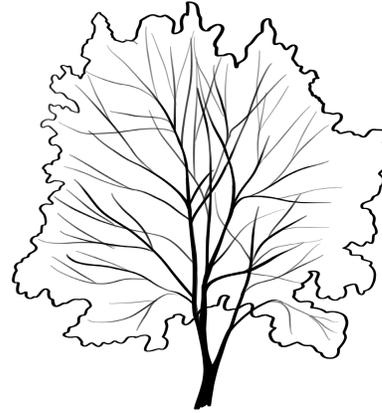
<b>ZONE</b>	6A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

#### CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Inconspicuous, greenish-yellow clusters
<b>WIDTH</b>	15-25'	<b>FRUIT</b>	Samara
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Glossy dark green turns to variable, excellent, yellow or red in late fall
<b>FORM</b>	Oval to rounded, low branching tendency	<b>BARK</b>	Ornamental mix of gray, brown, and orange, exfoliating in scales and plates

#### PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically few, but susceptible to Asian longhorned beetle	<b>CULTIVARS</b>	StreetWise® 'ABTIR' can easily be trained into a single leader, burgundy fall color; Raising Blaze™ 'EOAB-1' has great heat tolerance, a reduced fruit crop, and notable orange to red fall color; 'Mino-yatsubusa' has a graceful form, grows to be only 4' x 10'
<b>TOLERATES</b>	Drought, heat, pollution		
<b>TRANSPLANT</b>	Moderately easy		



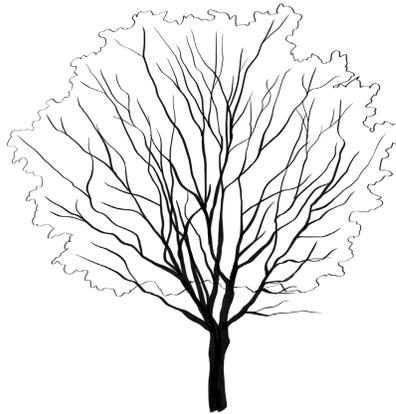
#### NOTES & LIMITATIONS

This small, adaptable, and ornamental maple makes a great street tree, although its low branches may require pruning. Young trees may experience twig dieback in harsh winters.



# HEDGE MAPLE

*Acer campestre*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	25-35'	<b>FLOWER</b>	Inconspicuous green clusters
<b>WIDTH</b>	25-35'	<b>FRUIT</b>	Samara
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Dark green turns to variable yellow in late fall
<b>FORM</b>	Rounded, low branching tendency	<b>BARK</b>	Gray-black with shallow ridges and furrows giving corky appearance

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically few, but susceptible to Asian longhorned beetle	<b>CULTIVARS</b>	Queen Elizabeth™ 'Evelyn' is more vigorous and has a more upright, oval habit; 'Schichtel's Upright' has a more narrow form; Metro Gold® 'Panacek' is a notably tough urban tree with a narrow form, fewer seeds, and an improved yellow color
<b>TOLERATES</b>	Drought, heat, pollution, poor drainage, shearing		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

### NOTES & LIMITATIONS

This small, adaptable maple makes a great street tree, although its low branches may require pruning. Its common name is derived from its use as a hedge, especially in its native range of Europe.

# PAPERBARK MAPLE

*Acer griseum*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Inconspicuous
<b>WIDTH</b>	10-30'	<b>FRUIT</b>	Samara
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark blue-green turns to brilliant red in fall
<b>FORM</b>	Oval to rounded	<b>BARK</b>	Ornamental, exfoliating cinnamon-brown, peels into thin sheets, has polished smooth patches

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically few, but susceptible to Asian longhorned beetle	<b>CULTIVARS</b>	A. griseum x A. nikoense: Gingerbread™ 'Ginzam' is faster growing, may be more heat tolerant; 'Cinnamon Flake' has bark that flakes in smaller strips
<b>TOLERATES</b>	-		
<b>TRANSPLANT</b>	Difficult- B&B or CG recommended		

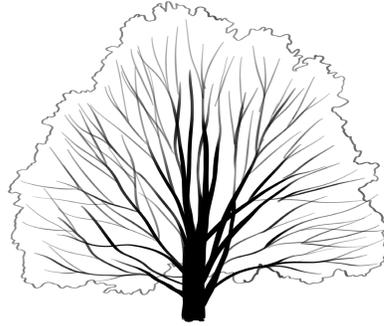
### NOTES & LIMITATIONS

Although it does not tolerate tough urban sites, this small maple makes a great addition to the landscape, with its extraordinary bark giving it year-round ornamental value. May have limited availability, and is quite slow growing.



# MIYABE MAPLE

*Acer miyabei*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	30-45'	<b>FLOWER</b>	Inconspicuous greenish-yellow pyramidal clusters
<b>WIDTH</b>	30-40'	<b>FRUIT</b>	Samara
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Semi-glossy, dark green turns to short-lived yellow in late fall
<b>FORM</b>	Upright oval to rounded, low branching tendency	<b>BARK</b>	Dark gray with rough, corky appearance

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically few, but susceptible to Asian longhorned beetle	<b>CULTIVARS</b>	Slate Street™ 'Morton' has an upright oval form, good golden fall color, reportedly heat tolerant; Rugged Ridge® 'JFS-KW3AMI' is notably tough and adaptable, with more ornamental bark
<b>TOLERATES</b>	Drought		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

## NOTES & LIMITATIONS

Often compared to *A. campestre*, this adaptable maple is recommended for landscapes, or on streets if planting site is large. May have limited availability.

# RED MAPLE

*Acer rubrum*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3B	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

## CHARACTERISTICS

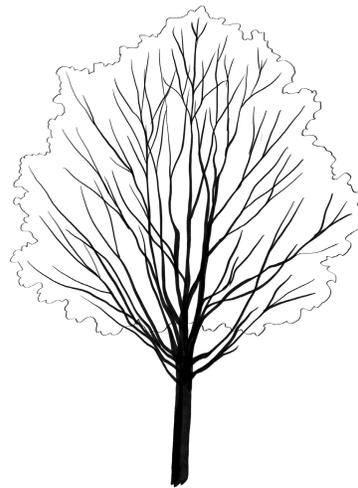
<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Showy reddish flowers in clusters, monoecious
<b>WIDTH</b>	30-70'	<b>FRUIT</b>	Samara, often red
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Medium green turns to variable, often excellent, yellow, orange, or red in early fall
<b>FORM</b>	Often pyramidal in youth, narrow upright to rounded at maturity	<b>BARK</b>	Ornamental silver-gray in youth turns to scaly gray-brown

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Verticillium wilt, leaf hoppers, borers, Asian longhorned beetle	<b>CULTIVARS</b>	Many available: Northwood® 'Northwood' tolerates harsh winter conditions, has less dependable color; Red Sunset® 'Franks Red' has great early fall color; 'Bowhall' better tolerates flooding, has pale orange flowers; 'New World' is upright and more narrow
<b>TOLERATES</b>	Pollution, flooding, poor drainage		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

## NOTES & LIMITATIONS

Although overplanted in Massachusetts, this adaptable maple can make a great addition to just about any large site. Traits, including cold hardiness, is heavily dependent on seed source. Chlorosis may be exhibited when growing in alkaline soils, and may be susceptible branch breakage. Although climate change projections show a potential loss of habitat suitability for this species in Massachusetts, it may be able to adapt.





# SUGAR MAPLE

*Acer saccharum*

## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, tolerates shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

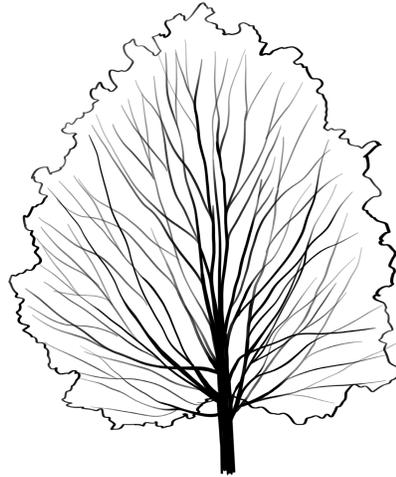
<b>HEIGHT</b>	45-75'	<b>FLOWER</b>	Greenish-yellow pendulous clusters
<b>WIDTH</b>	35-70'	<b>FRUIT</b>	Samara
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Medium to dark green turns to varying, brilliant yellow, orange, or red in fall
<b>FORM</b>	Upright oval to rounded, dense branching	<b>BARK</b>	Smooth, gray-brown in youth, deeply furrowed with long scaly plates at maturity

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Verticillium wilt, leaf scorch, Asian longhorned beetle	<b>CULTIVARS</b>	Many available: Apollo®, Fairview®, Fall Fiesta®, Green Mountain®, and Unity® are most cold hardy; Adirondack®, Crescendo™, Fiddler's Creek™, 'Legacy', and Steeple™ reportedly drought tolerant; 'Caddo' is extremely drought tolerant; 'Sugar Cone' grows only 25' x 13'
<b>TOLERATES</b>	-		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

## NOTES & LIMITATIONS

Although overplanted in Massachusetts, this stately maple is can provide beauty and shade for landscapes with enough space for its wide rooting system. Reportedly sensitive to heat, salt, and pollution, so planting in high-stress environments is not recommended. Although climate change projections show a potential loss of habitat suitability for this species in Massachusetts, it may be able to adapt.



# PURPLEBLOW MAPLE

*Acer truncatum*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

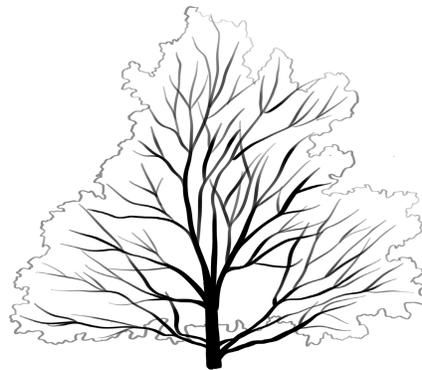
<b>HEIGHT</b>	25-30'	<b>FLOWER</b>	Bright yellow flowers emerge in spring before leaves
<b>WIDTH</b>	25-30'	<b>FRUIT</b>	Samara
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Emerging purplish-red, glossy green leaves turn to yellow-orange and red in fall
<b>FORM</b>	Rounded with a broad crown and low branching tendency	<b>BARK</b>	Gray-brown, rough and fissured at maturity

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically few, but susceptible to Asian longhorned beetle	<b>CULTIVARS</b>	Main Street® 'AT-WF1' has an oval-rounded form and brilliant orange-red fall color; 'Fire Dragon' reportedly very heat tolerant
<b>TOLERATES</b>	Drought		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

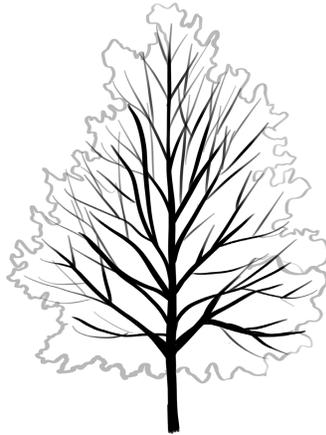
## NOTES & LIMITATIONS

Also known as Shantung Maple, this species is reportedly adaptable and quite tolerant of the adverse conditions found in the urban environment, but data is limited due to its rareness. May have limited availability. Lower branches may require pruning for street use.



# FREEMAN MAPLE

*Acer x freemanii*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	40-75'	<b>FLOWER</b>	Greenish-yellow to red clusters, inconspicuous to showy
<b>WIDTH</b>	20-40'	<b>FRUIT</b>	Samara, sometimes red turning to brown, seedless forms available
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Varies by cultivar, often good red fall color
<b>FORM</b>	Varies by cultivar	<b>BARK</b>	Ornamental silvery-gray

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically few, but susceptible to Asian longhorned beetle	<b>CULTIVARS</b>	Many available: Armstrong Gold® columnar form grows 15-20' wide, with brighter foliage; Sienna Glen® 'Sienna' grows 35' wide, pyramidal; Autumn Blaze® 'Jeffersred' grows 40' wide, broadly oval, great orange-red fall color, Society of Municipal Arborists' 2004 Urban Tree of the Year
<b>TOLERATES</b>	Flooding, poor drainage		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

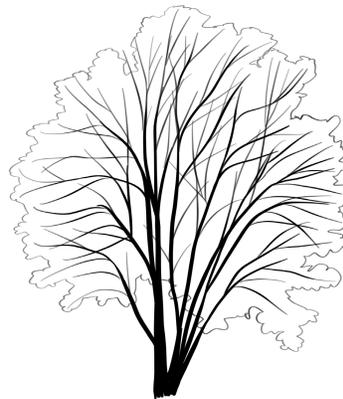
## NOTES & LIMITATIONS

Species is a cross between *A. rubrum* and *A. saccharinum*. Is said to have the strong branching attachment of *A. rubrum* with the fast growth of *A. saccharinum*, and less possibility of chlorosis than *A. rubrum*.



# SERVICEBERRY SPECIES

*Amelanchier spp.*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Sensitive to dry soil conditions

## CHARACTERISTICS

<b>HEIGHT</b>	15-25'	<b>FLOWER</b>	White, fragrant, showy
<b>WIDTH</b>	15-30'	<b>FRUIT</b>	Edible purplish-blue to black berries
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Emerging purple, dark green turns to yellow-orange or red in early fall
<b>FORM</b>	Upright-oval; grown as a small tree or multi-stemmed shrub	<b>BARK</b>	Ornamental, smooth, dull gray with dark, horizontal fissures

## PLANTING CONSIDERATIONS

<b>PESTS</b>	None serious, but susceptible to rusts, scales, aphids, mildews	<b>CULTIVARS</b>	Spring Flurry® 'JFS-Arb' is reportedly suitable for street sites; 'Autumn Brilliance' has much better heat and drought tolerance than species; 'Majestic' shows heat tolerance; 'Ballerina' is reportedly resistant to leaf spot and fire blight
<b>TOLERATES</b>	Poor drainage		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

## NOTES & LIMITATIONS

Serviceberry species, such as *A. arborea*, *A. laevis*, *A. canadensis*, and *A. grandiflora* are highly interchangeable. They prefer moist growing conditions, and although they may not be well-suited for highly stressful sites, this native species can provide year-round ornamental value to landscapes and sites under utility lines. Although climate change projections show a potential for a partial loss of habitat suitability for this species in Massachusetts, it may be able to adapt.

# RED HORSECHES TNUT

*Aesculus xcarnea*

## ENVIRONMENTAL C ONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Fullsun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

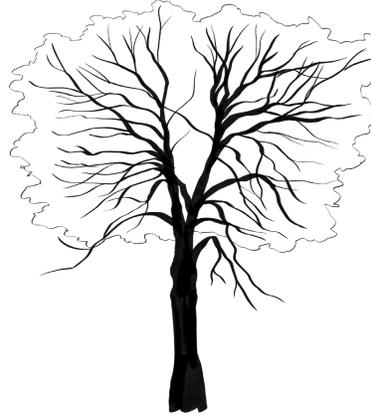
<b>HEIGHT</b>	30-50'	<b>FLOWER</b>	Upright pyramidal clusters of showy pink to red flowers
<b>WIDTH</b>	30-40'	<b>FRUIT</b>	Glossy brown nuts with slightly prickly husks
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark green turns to brown in fall
<b>FORM</b>	Rounded to broad-rounded, oftendense	<b>BARK</b>	Dark gray-brown, potentially becoming platy and exfoliating

## PLANTING C ONSIDERATIONS

<b>PESTS</b>	Fungal blight can cause browning leaves, less susceptible to leaf scorch, blotch, & mildew than <i>A. hippocastanum</i>	<b>CULTIVARS</b>	'Briotii' is smaller, nearly fruitless, has bright red flowers; 'Fort McNair' is reportedly less susceptible to leaf blight; 'O'Neill' is rarely available, but has large, rose-red flowers
<b>TOLERATES</b>	Variety of soil conditions		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

## NOTES & LIMITATIONS

A hybrid superior to its parents, *A. pavia* and *A. hippocastanum*, Red Horsechestnut is reportedly adaptable to a variety of soils, boasts extremely ornamental flowers, and causes less litter.



# RIVER BIRCH

*Betula nigra*



## ENVIRONMENTAL C ONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates dry and saturated soil

## CHARACTERISTICS

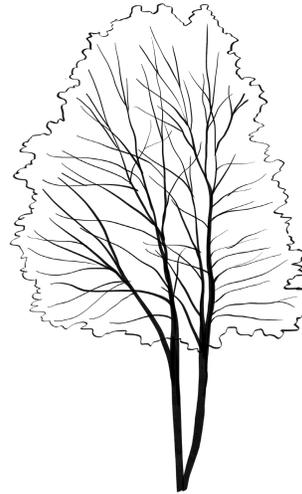
<b>HEIGHT</b>	40-70'	<b>FLOWER</b>	Catkins
<b>WIDTH</b>	40-60'	<b>FRUIT</b>	Inconspicuous, small nutlets inside catkins
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Medium green occasionally turns to yellow in fall
<b>FORM</b>	Pyramidal to oval in youth, rounded with maturity; often multi-stemmed	<b>BARK</b>	Ornamental; thin, shiny red-brown in youth, orange-brown and exfoliating at maturity

## PLANTING C ONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	Dura-Heat® 'Moonshine' grows to be 45' x 35'; Fow Valley® 'Little King' only grows to be 15' x 15'; Heritage® 'Cully' named Society of Municipal Arborists' 2002 Urban Tree of the Year
<b>TOLERATES</b>	Flooding, heat, salt, poor drainage		
<b>TRANSPLANT</b>	Moderately difficult BR, easier B&B or CG		

## NOTES & LIMITATIONS

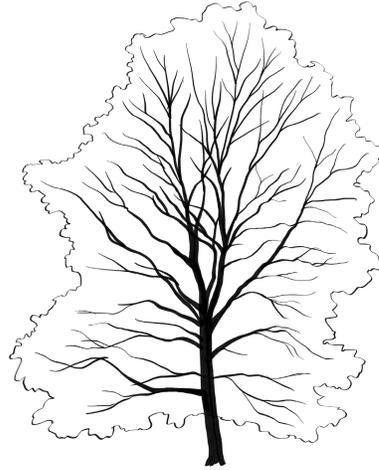
This ornamental, adaptable species can be used for sites along streams and naturalized areas, as well as urban sites. Leaves may prematurely drop under drought conditions, may be susceptible to branch breakage, and chlorosis may be exhibited when growing in alkaline soil.





# COMMON HORNBEAM

*Carpinus betulus*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	35-60'	<b>FLOWER</b>	Catkins
<b>WIDTH</b>	30-40'	<b>FRUIT</b>	Green to brown nutlets in chain-like clusters
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Dark green turns to yellowish-green in fall
<b>FORM</b>	Pyramidal-oval to oval-rounded	<b>BARK</b>	Smooth, dark gray

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free, but susceptible to Japanese beetle	<b>CULTIVARS</b>	'Fastigiata' is more common than the species in commerce, develops a dense, pyramidal form; 'Globosa' is a rounded, dense and only grows 15-20' tall
<b>TOLERATES</b>	Pollution, shearing		
<b>TRANSPLANT</b>	Difficult BR, easier B&B or CG		

## NOTES & LIMITATIONS

This adaptable species is especially useful for hedging. Low branches may require pruning for street use, may be susceptible to branch breakage, and may have limited availability.

# AMERICAN HORNBEAM

*Carpinus caroliniana*



## ENVIRONMENTAL CONDITIONS

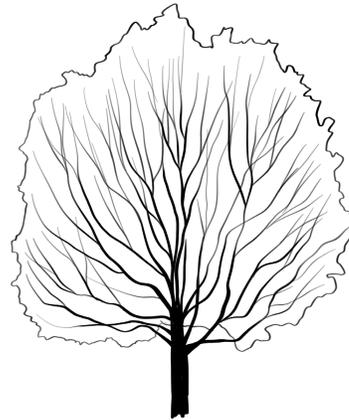
<b>ZONE</b>	3A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Prefers partial shade, tolerates full sun and shade	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Pendulous clusters of 3-winged leafy bracts
<b>WIDTH</b>	20-30'	<b>FRUIT</b>	Small nutlets in pendulous clusters, green turns to brown in fall
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark green turns to brilliant yellow, orange, or red in fall
<b>FORM</b>	Upright-spreading, round or flat-topped	<b>BARK</b>	Ornamental, smooth, gray, and irregularly fluted

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	Native Flame® 'JFS-KW6' is a top choice due to its dependable excellent red fall color and upright form; Palisade® 'CCSQU' has a more narrow, oval, dense form; Rising Fire® 'Uxbridge' has a columnar form and vigorous growth rate
<b>TOLERATES</b>	Flooding, pollution, poor drainage, shearing		
<b>TRANSPLANT</b>	Difficult B&B and BR, slow to establish		



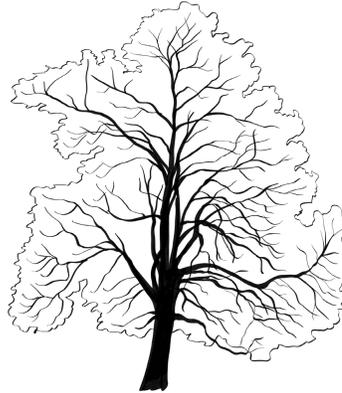
## NOTES & LIMITATIONS

This native species is great for a variety of sites - in naturalized areas along streams, under utility lines, in the urban landscape, or along your yard as a hedge.



## NORTHERN CATALPA

*Catalpa speciosa*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Showy, white, bell-shaped in upright clusters with yellow and/or purple spots inside
<b>WIDTH</b>	20-40'	<b>FRUIT</b>	Thin, bean-like capsule, green turns to brown, persists through winter
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Bright green turns to poor yellow-green in fall
<b>FORM</b>	Irregular, open-rounded to narrow-oval	<b>BARK</b>	Grayish-brown with scaly, flat ridges at maturity

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Typically not serious, but susceptible to leaf spots, powdery mildew, twig blight, verticillium wilt	<b>CULTIVARS</b>	Heartland® 'Hiawatha 2' has a more narrow, upright form; 'Pulverulenta' has speckled variegation on foliage
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**TOLERATES** Drought, heat, poor drainage, pollution

**TRANSPLANT** Easy B&B or ≤2" caliper BR

### NOTES & LIMITATIONS

This species is both native and tolerant to the adverse conditions found in the urban environment, but has begun to cause concern related to invasive potential - recommended to not plant near natural settings where they could invade and to monitor. Fruit can be litter issue, and it may have limited availability.

## SUGAR HACKBERRY

*Celtis laevigata*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	60-80'	<b>FLOWER</b>	Inconspicuous clusters
<b>WIDTH</b>	50'	<b>FRUIT</b>	Edible, small orange-red to blue-black drupes in fall
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Light green turns to unimpressive yellow in fall
<b>FORM</b>	Broadly rounded with spreading, pendulous branches	<b>BARK</b>	Light gray, can be smooth or covered with corky/warty ridges

### PLANTING CONSIDERATIONS

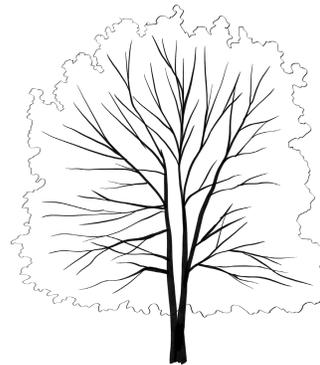
<b>PESTS</b>	None serious, but susceptible to mistletoe, scale, leaf spot; resistant to witches' broom & nipple gall	<b>CULTIVARS</b>	May have limited availability: 'All Seasons' is slightly smaller and faster growing; 'Magnifica' is a <i>C. occidentalis</i> and <i>C. laevigata</i> hybrid, yields little to no fruit, and is resistant to leafhoppers
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**TOLERATES** Drought, heat, salt, poor drainage, pollution, wind

**TRANSPLANT** B&B recommended, slow to establish

### NOTES & LIMITATIONS

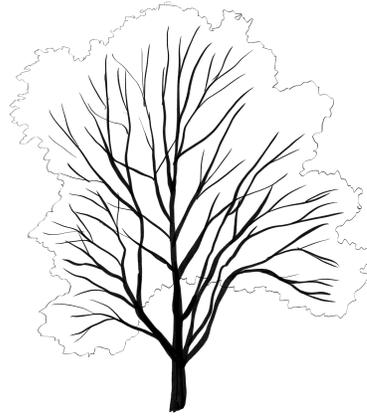
Although not known for its ornamental value, this native species is treasured for its adaptability to adverse conditions. Birds enjoy its fruit, which has a sweet, date-like taste.





## COMMON HACKBERRY

*Celtis occidentalis*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade, shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Small, greenish-yellow inconspicuous clusters
<b>WIDTH</b>	40-60'	<b>FRUIT</b>	Yellow or orange-red, fleshy drupe; edible, sweet date taste
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Medium green turns to yellow in fall
<b>FORM</b>	Pyramidal in youth, rounded at maturity with ascending-arching branches	<b>BARK</b>	Gray, rough and corky ridges, stems have zig-zag appearance

### PLANTING CONSIDERATIONS

<b>PESTS</b>	None serious, susceptible to witches broom, nipple gall, powdery mildew	<b>CULTIVARS</b>	'Praire Pride' produces less fruit, does not develop witches broom or gall, has a compact uniform crown; 'Praire Sentinel' 'JFS-KSU1' is 10' wide, great for street tree use
<b>TOLERATES</b>	Drought, flooding, heat, pollution, poor drainage	<b>TRANSPLANT</b>	Difficult BR, B&B recommended, may be slow to establish

### NOTES & LIMITATIONS

Great for large urban sites, this tolerant species' deep rooting tendency will rarely lift sidewalks and can help control soil erosion. May be susceptible to branch breakage, and its overall attractiveness can greatly vary.

## KATSURA TREE

*Cercidiphyllum japonicum*

### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates only occasional periods of saturated soil

### CHARACTERISTICS

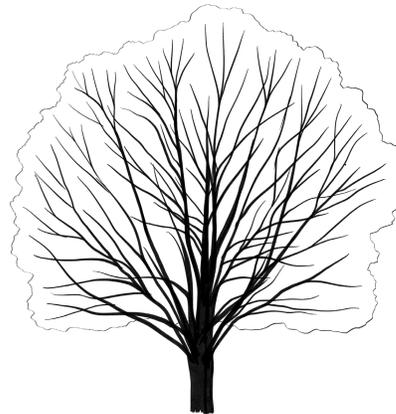
<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Inconspicuous green flowers emerge before leaves in spring
<b>WIDTH</b>	25-60'	<b>FRUIT</b>	Small banana-shaped pods in clusters
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Emerging vibrant red-purple, blue-green in summer, outstanding yellow-orange in fall
<b>FORM</b>	Upright pyramidal in youth, rounded with age, dense crown; single- and multi-stemmed forms	<b>BARK</b>	Brown, slightly exfoliating with age

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Resistant to verticillium wilt	<b>CULTIVARS</b>	'Red Fox' and 'Rotfuchs' have red foliage and are slower growing than species; 'Amazing Grace' has weeping form, grows to be 25' tall, and more wide than high; 'Heronwood Globe' has globe-shaped form, grows to be 15' tall
<b>TOLERATES</b>	Flooding, poor drainage		
<b>TRANSPLANT</b>	Difficult		

### NOTES & LIMITATIONS

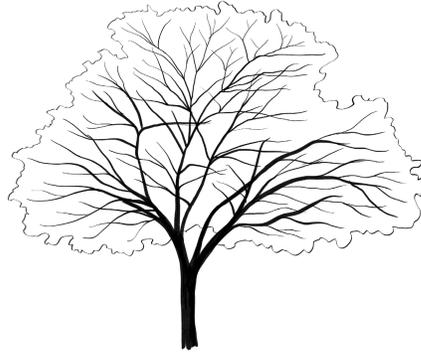
This species boasts attractive bark, an elegant form, and excellent fall color that gives off a pleasant aroma. However, several management concerns may not make it the best suited for tough urban sites: may be susceptible to branch breakage, trunk can sunscald easily in youth, sensitive to drought, and requires ample moisture during establishment years. Provides prolific surface-roots.





## EASTERN REDBUD

*Cercis canadensis*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil, avoid any periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Showy and profuse, purple-pink, pea-like, bloom early spring
<b>WIDTH</b>	25-35'	<b>FRUIT</b>	Flat green pods, light green turns to brown
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Emerging glossy red-purple, dark green turns to greenish-yellow to golden in fall
<b>FORM</b>	Rounded to spreading and somewhat flat-topped, multi-stemmed or low branching	<b>BARK</b>	Gray-brown in youth, ornamental at maturity with dark brown scales exposing inner cinnamon color

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Cankers and verticillium wilt can be serious when tree is stressed	<b>CULTIVARS</b>	'Appalachian Red' have beautiful bright pink flowers; 'Forest Pansy' suitable for zone 5b or 6, slightly smaller than species, slow growth rate; 'Northern Strain' is often more cold hardy; 'Alba' sometimes called 'Whitebud', has fast growth rate, lighter green foliage, white flowers
<b>TOLERATES</b>	Drought		
<b>TRANSPLANT</b>	&B or CG recommended, BR moderately difficult, establishment may be difficult		

### NOTES & LIMITATIONS

Named the Society of Municipal Arborists' 2010 Urban Tree of the Year, this native species is known as the champion of all small, flowering landscape trees. Paying close attention to selecting proper choice of genetic material is recommended for survival in zones <6a.

## ATLANTIC WHITE CEDAR

*Chamaecyparis thyoides*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

### CHARACTERISTICS

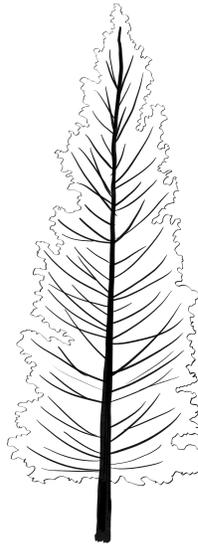
<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	10-20'	<b>FRUIT</b>	Small brown cones
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Blueish-green needles turn bronze in winter and persist
<b>FORM</b>	Narrowly columnar	<b>BARK</b>	Light gray to reddish-brown, irregularly furrowed

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Andelyensis' has a wide pyramidal habit, grows to be 10' tall, and has purple needles in winter; 'Aurea' has a dense, conical form and grows to be 15' tall; 'Red Star' has a compact, dense columnar form, with red or purple needles in winter
<b>TOLERATES</b>	Flooding, poor drainage		
<b>TRANSPLANT</b>	Difficult BR		

### NOTES & LIMITATIONS

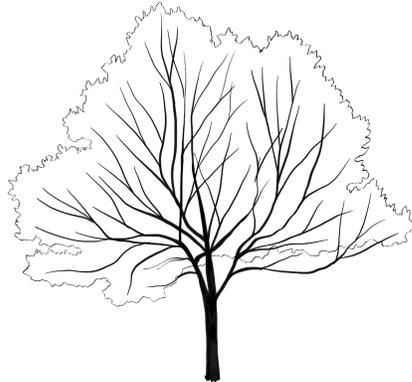
This native evergreen is especially useful for coastal or wet planting sites. It typically does best with protection from strong winds and deer browsing. Although climate change projections show a potential for a partial loss of habitat suitability for this species in Massachusetts, it may be able to adapt. May have limited availability.





# WHITE FRINGETREE

*Chionanthus virginicus*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade, shade	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	15-25'	<b>FLOWER</b>	Showy white, slightly fragrant, fringe-like, low-hanging
<b>WIDTH</b>	10-25'	<b>FRUIT</b>	Blue-black, olive-like
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Medium to dark green turns to excellent yellow-green-brown in fall
<b>FORM</b>	Varies from irregular and open to dense and rounded; often multi-stemmed	<b>BARK</b>	Light gray-brown, smooth in youth to slightly ridged in maturity

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Emerald Knight' (male) has long glossy green foliage and upright form, 15-20' high; 'Spring Fleecing' (male) has a loose, graceful form with shiny dark green leaves and abundant flowers; Prodigy® 'CVSTF' has a rounded form with many cloud-like white flowers
<b>TOLERATES</b>	Drought, flooding, poor drainage, pollution		
<b>TRANSPLANT</b>	Possibly difficult; small B&B or CG recommended		

## NOTES & LIMITATIONS

Although this tree's traits are reportedly quite variable within the species, it typically is adaptable and requires little maintenance once established.

# YELLOWWOOD

*Cladrastis kentuckea*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

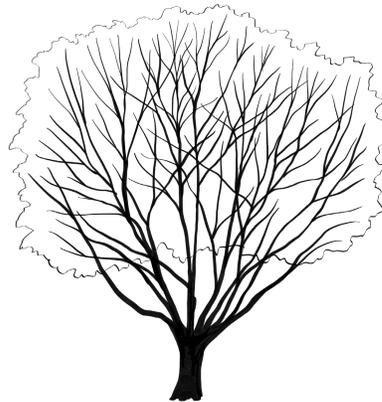
<b>HEIGHT</b>	30-50'	<b>FLOWER</b>	Clusters of fragrant, showy white pea-like flowers; blooms heavily every 2-3 years
<b>WIDTH</b>	40-55'	<b>FRUIT</b>	Flat seed pods, green ripens to brown in fall
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Bright green in summer turns to brilliant yellow in fall with sweet scent
<b>FORM</b>	Broad-rounded with low, gracefully arching branches	<b>BARK</b>	Ornamental, smooth light gray

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Rosea', also known as 'Perkins Pink', has a pink flowering form, notable drought tolerance, but may be hard to find
<b>TOLERATES</b>	Variety of soil conditions		
<b>TRANSPLANT</b>	B&B or ≤2" caliper BR recommended		

## NOTES & LIMITATIONS

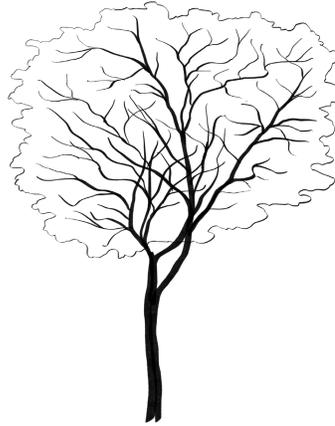
Named the Society of Municipal Arborists' 2015 Urban Tree of the Year, this native species makes an attractive addition to the landscape. It may be susceptible to branch breakage, and its thin bark is sensitive to damage and sun scald.





# JAPANESE CLETHRA

*Clethra barbinervis*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Prefers partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry or saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	10-20'	<b>FLOWER</b>	Showy, slightly fragrant, white flowers; attracts butterflies
<b>WIDTH</b>	10-20'	<b>FRUIT</b>	Small capsules, turn brown in fall
<b>GROWTH</b>	Fast	<b>FOLIAGE</b>	Dark green turns to bronze-red in fall
<b>FORM</b>	Rounded; grown as a small tree or multi-stemmed shrub	<b>BARK</b>	Rich gray-brown to cinnamon-brown, smooth, exfoliating

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Mites can be an issue in hot, dry environments	<b>CULTIVARS</b>	First Snow® 'Takeda Nishiki' has variegated foliage and polished, tricolored bark
<b>TOLERATES</b>	Flooding, salt		
<b>TRANSPLANT</b>	B&B or CG recommended, may be slow to establish		

## NOTES & LIMITATIONS

This ornamental species is most successful when planted in a moist, shady location. It may have limited availability, and may experience twig tip dieback during its first winter.

# KOUSA DOGWOOD

*Cornus kousa*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

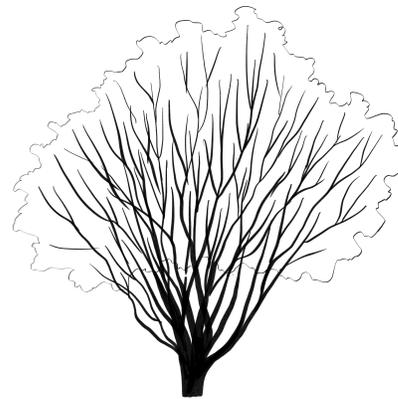
<b>HEIGHT</b>	15-30'	<b>FLOWER</b>	Small, greenish-yellow, upright flowers held by four large, showy creamy white bracts
<b>WIDTH</b>	15-30'	<b>FRUIT</b>	Potentially showy, red, raspberry-like, edible
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark green turns to impressive deep red or red-purple
<b>FORM</b>	Vase-shaped with upright branches in youth, rounded with horizontal, layered branches at maturity	<b>BARK</b>	Variable, often ornamental, exfoliates to reveal mix of gray-tan and mahogany brown inner bark

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Resistant to dogwood anthracnose	<b>CULTIVARS</b>	Many available; common cultivars with shorter height and colorful flower displays include 'Milky Way', 'Satomi', and 'Beni Fuji'
<b>TOLERATES</b>	Variety of soil conditions		
<b>TRANSPLANT</b>	Moderately easy		

## NOTES & LIMITATIONS

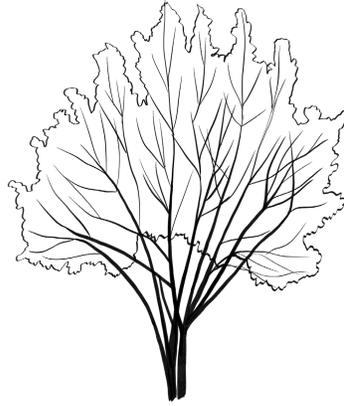
This ornamental species is less common in the landscape than *C. florida*, but is reportedly more adaptable to a variety of difficult soil conditions. May require pruning for street use.





# CORNELIANCHERRY DOGWOOD

*Cornus mas*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	15-25'	<b>FLOWER</b>	Showy, small yellow flowers emerge in early spring
<b>WIDTH</b>	15-20'	<b>FRUIT</b>	Bright red, edible, cherry-like fruit
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Glossy, dark green in summer turns to green-yellow with purplish-red highlights in fall
<b>FORM</b>	Rounded to oval with a short trunk and spreading, upright branching; often multi-stemmed	<b>BARK</b>	Ornamental brown and gray, exfoliating

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Golden Glory' has a more narrow and upright form, more abundant flowers, larger leaves and fruit, but may be less cold hardy; 'Saffron Sentinel™', 'JFS PN4Legacy' has a columnar form
<b>TOLERATES</b>	Salt		
<b>TRANSPLANT</b>	B&B or ≤2" caliper BR recommended, may be slow to establish		

## NOTES & LIMITATIONS

A beautiful, adaptable dogwood that is reportedly underutilized in the landscape. Although fruit can be a litter issue, it is valuable to birds and can be used for syrups and preserves. Proper pruning can help to better reveal exfoliating bark and make it more suitable for street use.

# FLOWERING DOGWOOD HYBRIDS

*Cornus x rutgerensis (C. florida x C. kousa)*



## ENVIRONMENTAL CONDITIONS

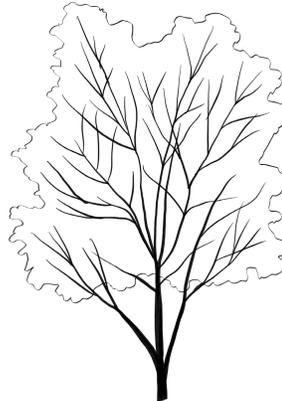
<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, partial shade, shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	10-20'	<b>FLOWER</b>	Showy, clusters in center of four white or pink bracts
<b>WIDTH</b>	10-20'	<b>FRUIT</b>	Clusters of bright red fruit ripen in fall
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Green turns to reddish-purple in fall
<b>FORM</b>	Varies	<b>BARK</b>	Gray-brown

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Resistant to dogwood anthracnose, powdery mildew and dogwood borer	<b>CULTIVARS</b>	The Stellar® Series, from Rutgers University, all show good resistance to powdery mildew and dogwood anthracnose. Aurora®, Celestial®, Constellation®, Ruth Ellen®, Stardust®, and Stellar Pink®
<b>TOLERATES</b>	-		
<b>TRANSPLANT</b>	Moderately easy		



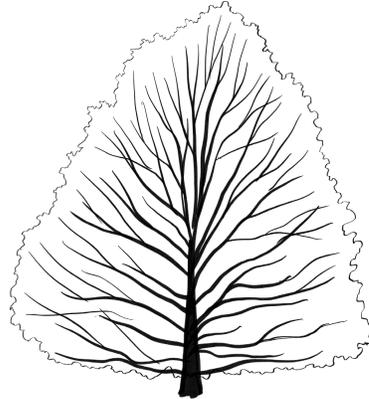
## NOTES & LIMITATIONS

Popular in the landscape due to its outstanding ornamental traits, this species is susceptible to numerous pests and diseases. The use of resistant cultivars is strongly recommended; listed here are several improved hybrids from Rutgers University.



# TURKISH FILBERT

*Corylus colurna*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	40-50'	<b>FLOWER</b>	Inconspicuous
<b>WIDTH</b>	15-35'	<b>FRUIT</b>	Small, edible nuts inside fringed husks
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Dark green in summer may turn to yellow or purple-red in fall, but often drop yellow-green
<b>FORM</b>	Broadly pyramidal with strong central leader	<b>BARK</b>	Pale gray-brown bark exfoliates with age, exposing orange-brown inner bark

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Eastern filbert blight can occasionally be a serious issue	<b>CULTIVARS</b>	-
<b>TOLERATES</b>	Drought, heat, pollution		
<b>TRANSPLANT BR</b>	difficult, B&B recommended, may be slow to establish		

## NOTES & LIMITATIONS

Although well-suited for urban environments, watering is essential during establishment. This species' fruit can be a litter issue, and it may have limited availability.

# AMERICAN SMOKETREE

*Cotinus obovatus*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

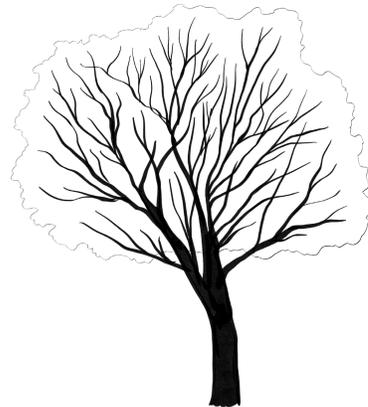
<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Green to purple pyramidal
<b>WIDTH</b>	15-30'	<b>FRUIT</b>	Often sparse, but attractive tan clusters; silky hairs give 'smoky' appearance
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Emerging bright light green, blue-green turns to showy yellow-orange-red or red-purple in fall
<b>FORM</b>	Oval to rounded, low branching and absent central leader creates short trunk; single-stem form is rare	<b>BARK</b>	Attractive gray to gray-brown, scaly with age; stems often orange

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Verticillium wilt	<b>CULTIVARS</b>	'Grace' and 'Red Leaf' may have limited availability
<b>TOLERATES</b>	Drought		
<b>TRANSPLANT</b>	difficult B&B or BR		

## NOTES & LIMITATIONS

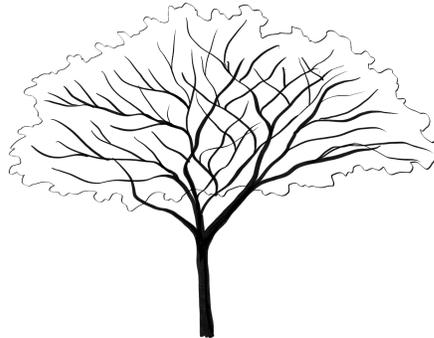
Although this native species' low branching may require pruning for street use, its impressive drought tolerance make it a promising choice for urban landscapes.





# THORNLESS COCKSPUR HAWTHORN

*Crataegus crus-galli* var. *inermis*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	White clusters, unpleasant odor, short-lived bloom
<b>WIDTH</b>	20-35'	<b>FRUIT</b>	Showy clusters of bright red berry-like fruit, persist into late fall or winter
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Glossy dark green turn to orange or red in fall
<b>FORM</b>	Round with spreading horizontal branching structure, single- and multi-stemmed forms	<b>BARK</b>	Silvery-gray

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to many-aphids, scales, fireblight, leaf blight, mildews, rusts	<b>CULTIVARS</b>	Crusader™ 'Cruzam' known for disease resistance, 15' x 15' wide
<b>TOLERATES</b>	Drought, heat, salt, pollution		
<b>TRANSPLANT</b>	B&B and BR difficult, may be slow to establish		

## NOTES & LIMITATIONS

This species boasts a strong adaptability to adverse conditions; its thornless variety is recommended for areas with foot traffic.

# WINTER KING HAWTHORN

*Crataegus viridis* 'Winter King'



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

## CHARACTERISTICS

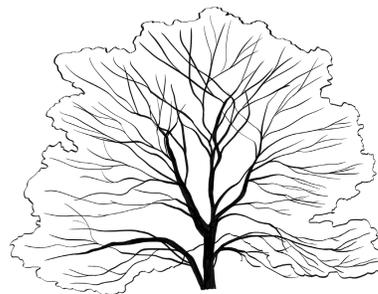
<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Showy white clusters
<b>WIDTH</b>	20-30'	<b>FRUIT</b>	Showy, bright red, persists through winter
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Glossy green turns to variable, yet excellent, fall color, often purple-red or gold
<b>FORM</b>	Rounded, vase-shaped branching	<b>BARK</b>	Thorny; ornamental, gray, exfoliates with age to expose orange-brown inner bark

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Shows resistance to cedar-hawthorn rust, less susceptible to pests than the <i>Crataegus</i> species	<b>CULTIVARS</b>	Information is cultivar-specific
<b>TOLERATES</b>	Salt, shearing		
<b>TRANSPLANT</b>	Difficult B&B or BR, somewhat slow to establish		

## NOTES & LIMITATIONS

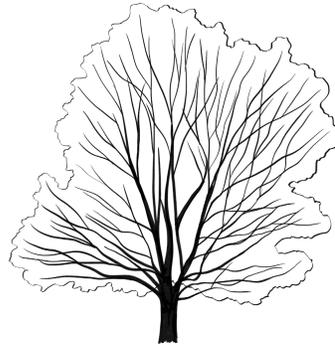
'Winter King' is the most common (and beloved) *C. viridis* cultivar, making a beautiful addition to the landscape. However, thorns should be considered in relation to planting location before selection.





# HARDY RUBBER TREE

*Eucommia ulmoides*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade, shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Inconspicuous blooms
<b>WIDTH</b>	40-60'	<b>FRUIT</b>	Small winged capsules
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Attractive glossy dark green turns pale yellow-green in early fall
<b>FORM</b>	Sparsely branched in youth, dense and rounded to broad-spreading at maturity	<b>BARK</b>	Gray-brown, ridged and furrowed at maturity

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	Emerald Point™ 'Empozam' has a columnar to narrow oval form, with smaller, heavily textured leaves
<b>TOLERATES</b>	Drought, heat, pollution, poor drainage		

**TRANSPLANT** Easy B&B

## NOTES & LIMITATIONS

Although this species is quite adaptable, it reportedly is rarely used in urban plantings. Requiring overall little maintenance, it would make a great addition to a landscape.

# GIN KGO

*Ginkgo biloba*



## ENVIRONMENTAL CONDITIONS

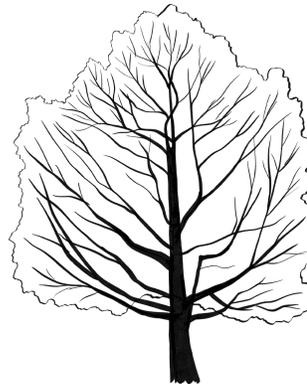
<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	50-80'	<b>FLOWER</b>	Inconspicuous
<b>WIDTH</b>	30-40'	<b>FRUIT</b>	Noxious smelling on female trees
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Bright green turns to brilliant yellow in fall
<b>FORM</b>	Sparse and irregular in youth, dense and pyramidal in maturity often with large, spreading branches	<b>BARK</b>	Light gray-brown, ridged

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Fastigiata' has an upright, columnar form; 'Autumn Gold' (male) has a broad-spreading habit; 'Golden Colonnade™' 'JFS-UGA2' (male) has a narrow, columnar form and strongly ascending branches; 'Princeton Sentry' has an upright habit, named Society of Municipal Arborists' 1996 Urban Tree of the Year
<b>TOLERATES</b>	Drought, heat, pollution, salt, wind and snow damage		
<b>TRANSPLANT</b>	Difficult BR, B&B recommended		



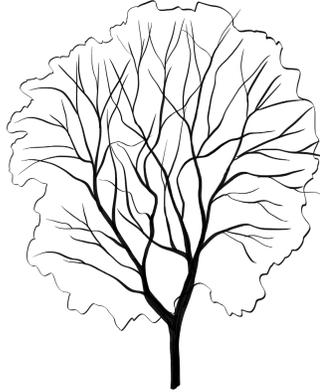
## NOTES & LIMITATIONS

This species is iconic for not only its fan-shaped leaves, but its adaptability to adverse conditions. Choosing male species is strongly recommended, as female trees produce noxious smelling fruit. May be over-planted.



# THORNLESS HONEYLOCUST

*Gleditsia triacanthos var. inermis*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	40-80'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	30-70'	<b>FRUIT</b>	Long, flat brown pods
<b>GROWTH</b>	Fast	<b>FOLIAGE</b>	Glossy light green turns to showy yellow in fall, drop early
<b>FORM</b>	Graceful, oval to rounded, upright-spreading to almost horizontal branching	<b>BARK</b>	Ornamental dark gray-brown with plate-like patches separated by furrows at maturity

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Overuse has encouraged severe issues: borers, leaf spot, webworm, powdery mildew, cankers	<b>CULTIVARS</b>	StreetKeeper® Draves' is narrow, tightly pyramidal, great for street use; Imperial® Impcole® grows to be less than 30' tall; Skyline® Skycole® is common, great for street use, named Society of Municipal Arborists' 1999 Urban Tree of the Year
<b>TOLERATES</b>	Drought, flooding, salt, pollution, poor drainage		

**TRANSPLANT** Easy B&B or ≤2" caliper BR

## NOTES & LIMITATIONS

Although possibly already over-planted, this native species is quite adaptable and attractive; its thornless variety is recommended for areas with foot traffic.

# KENTUCKY COFFEETREE

*Gymnocladus dioica*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

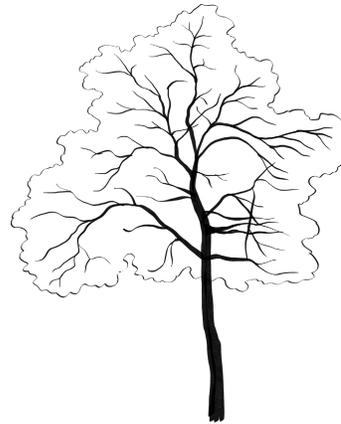
<b>HEIGHT</b>	50-75'	<b>FLOWER</b>	Greenish-white pyramidal clusters
<b>WIDTH</b>	40-50'	<b>FRUIT</b>	Leathery, brownish-black pods persist through winter
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Emerging pinkish-purple, blue-green turns to potentially good fall yellow
<b>FORM</b>	Sparse branching in youth, oval to vase shaped at maturity, upward arching branches	<b>BARK</b>	Gray-brown to dark brown, rough, with thin and scaly ridges curling out to expose orange-brown

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Stately Manor' is noted as the best of the male non-fruiting cultivars, grows to be 40' x 35'; Espresso™ Espresso-JFS® and Titan® J.C. McDaniel® are also male non-fruiting form
<b>TOLERATES</b>	Drought, salt		
<b>TRANSPLANT</b>	B&B or ≤2" caliper BR, slow to establish		

## NOTES & LIMITATIONS

Named the Society of Municipal Arborists' 2006 Urban Tree of the Year, this reportedly underutilized species can tolerate extremely adverse conditions. The pods on female species can be a litter issue.





# CAROLINA SILVERBELL

*Halesia carolina*

## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade, shade	<b>MOISTURE</b>	Intolerant of periods of dry soil

## CHARACTERISTICS

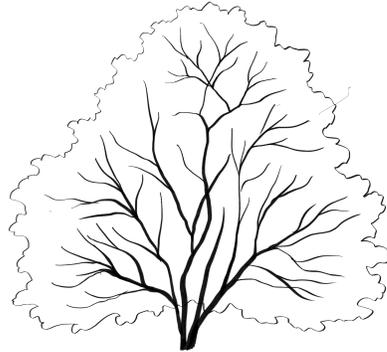
<b>HEIGHT</b>	20-40'	<b>FLOWER</b>	Showy white, bell-shaped and in clusters
<b>WIDTH</b>	20-35'	<b>FRUIT</b>	Oval with four wings
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Dark green turns to yellow-green in fall
<b>FORM</b>	Rounded, low branches, often multi-stemmed; single-stemmed specimens are pyramidal to oval	<b>BARK</b>	Brown in youth, gray-brown-black and striated at maturity

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'UConn Wedding Bells' is more compact, heavier flowering; 'Rosy Ridge' and 'Arnold Pink' have beautiful pink flowers
<b>TOLERATES</b>	Salt, pollution		
<b>TRANSPLANT</b>	Difficult, CG recommended over B&B		

## NOTES & LIMITATIONS

Especially useful for plantings along streams and in naturalized areas, this uncommon species is valued for its beautiful flowers. Not well-suited for tough sites; may exhibit chlorosis when growing in alkaline soil.



# WITCHHAZEL

*Hamamelis virginiana*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3B	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates only very occasional periods of dry soil

## CHARACTERISTICS

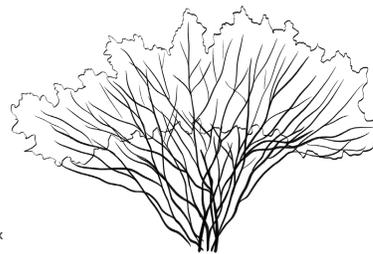
<b>HEIGHT</b>	10-30'	<b>FLOWER</b>	Fragrant, yellow, blooms in fall
<b>WIDTH</b>	15-20'	<b>FRUIT</b>	Woody capsule containing 2-4 seeds
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Bright to dark green turns to brilliant yellow in fall
<b>FORM</b>	Short trunk with spreading, crooked branches; grown as a small tree or multi-stemmed shrub	<b>BARK</b>	Smooth, gray to gray-brown

## PLANTING CONSIDERATIONS

<b>PESTS</b>	None serious, but susceptible to insect galls and Japanese beetles on foliage	<b>CULTIVARS</b>	'Green Thumb' is variegated, 8' x 8'; 'Lemon Lime' is also variegated; 'Harvest Moon' has showier flowers and grows to be 18' in height
<b>TOLERATES</b>	Salt, poor drainage, pollution		
<b>TRANSPLANT</b>	B&B or CG recommended		

## NOTES & LIMITATIONS

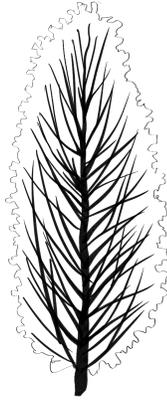
This native species provides fragrant flowers to the landscape each fall, and although it is sensitive to drought, it has been shown to be otherwise quite adaptable.





## EASTERN RED CEDAR

*Juniperus virginiana*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	40-50'	<b>FLOWER</b>	Male flowers are yellow, females are green, blooms in late winter
<b>WIDTH</b>	8-20'	<b>FRUIT</b>	Waxy, bluish cones
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Medium green needles turn bronze in winter
<b>FORM</b>	Densely columnar to broad-pyramidal	<b>BARK</b>	Reddish-brown, exfoliates in long strips

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to mites, bagworms, phomopsis blight, cedar-apple rust	<b>CULTIVARS</b>	'Burkii', 'Canaertii', 'Emerald Sentinel', and 'Grey Owl' are all utility line safe; 'Pendula' refers to many cultivars, all of which have spreading limbs and pendulous branchlets
<b>TOLERATES</b>	Drought, salt, pollution, shearing		

TRANSPLANT B&B or CG recommended

### NOTES & LIMITATIONS

This native evergreen can thrive under a wide variety of conditions, from urban sites to naturalized areas along the coast.

## GOLDENRAIN TREE

*Koeleruteria paniculata*



### ENVIRONMENTAL CONDITIONS

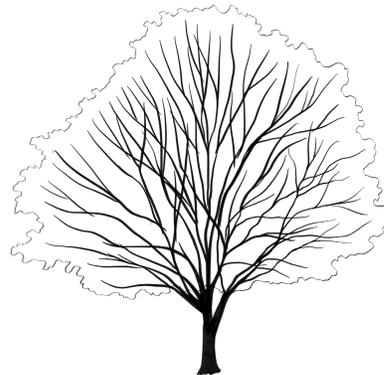
<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	30-40'	<b>FLOWER</b>	Rich yellow flowers in large, upright pyramidal clusters
<b>WIDTH</b>	30-40'	<b>FRUIT</b>	Papery capsules, green turns to yellow then to brown, persists through winter
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Emerging purplish-red, bright or dark green turns to golden, yellow, or yellow-green in fall
<b>FORM</b>	Rounded with upright-spreading, often sparse branches	<b>BARK</b>	Light gray-brown, ridged and furrowed

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'September' is hardy for zone 6, late summer/ fall flowering; 'Fastigiata' grows 25' x 4-6', making it useful near utility, but less ornamental
<b>TOLERATES</b>	Drought, heat, salt, pollution		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		



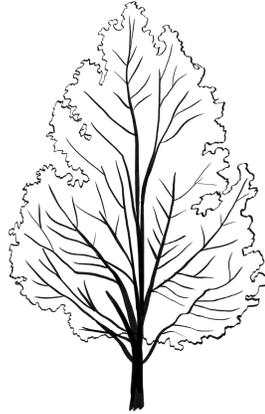
### NOTES & LIMITATIONS

Named the Society of Municipal Arborists' 2011 Urban Tree of the Year, this impressive urban species has begun to cause concern related to invasive potential - recommended to not plant near natural settings, where they could invade, and to monitor.



## AMERICAN SWEET GUM

*Liquidambar styraciflua*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry or saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	50-75'	<b>FLOWER</b>	Small, green, inconspicuous
<b>WIDTH</b>	40-65'	<b>FRUIT</b>	Woody, pendulous, burr-like and contain small seeds in capsules
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Glossy green turns to variable but excellent yellow, orange, red, and purple
<b>FORM</b>	Pyramidal in youth, oval to rounded at maturity	<b>BARK</b>	Gray-brown, with rough, deep furrows

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	Emerald Sentinel® 'Clydesform' is ideal for street-use with a narrow and compact form, slow growing; 'Rotundiloba' is the only fruitless cultivar; 'Moraine' is commonly used, has a upright rounded habit and great red fall color
<b>TOLERATES</b>	Flooding, poor drainage		
<b>TRANSPLANT</b>	B&B recommended over BR, may be slow to establish		

### NOTES & LIMITATIONS

Boasting excellent fall foliage, this common native species is especially useful for planting along streams. Although it has been shown to tolerate dry soils, it may not be well-suited to tough sites, as its fruit can be a litter issue, and it may exhibit chlorosis when growing in alkaline soil.

## TULIPTREE

*Liriodendron tulipifera*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates only occasional periods of dry and saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	70-90'	<b>FLOWER</b>	Tulip-shaped, yellow-green petals and orange base
<b>WIDTH</b>	35-50'	<b>FRUIT</b>	Cone-shaped clusters of woody samaras, persists through winter
<b>GROWTH</b>	Fast	<b>FOLIAGE</b>	Bright green turns to golden yellow in fall
<b>FORM</b>	Pyramidal in youth, oval-rounded at maturity	<b>BARK</b>	Ornamental, gray, furrowed with round to flat ridges

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	May have limited availability: 'Fastigiatum' and 'Arnold' have narrow form, 50-60' tall and 15-25' wide; 'Aureomarginatum' has ornamental, variegated foliage; Emerald City® 'JFS-Oz' is more straight and upright
<b>TOLERATES</b>	Flooding, poor drainage		
<b>TRANSPLANT</b>	Difficult B&B or BR, small caliper B&B recommended		

### NOTES & LIMITATIONS

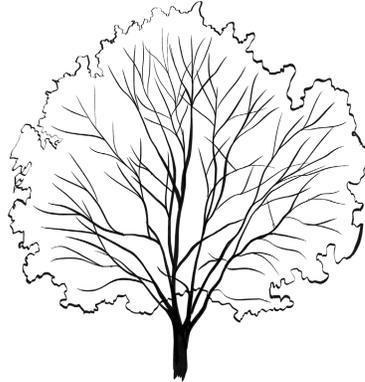
Named the Society of Municipal Arborists' 2018 Urban Tree of the Year, this species is sensitive to drought, and it may be susceptible to branch breakage, yet it still makes a great addition to almost any large, urban site.





## AMUR MAACKIA

*Maackia amurensis*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Small, dull white, pea-like flowers in upright clusters, may not bloom well every year
<b>WIDTH</b>	20-30'	<b>FRUIT</b>	Flat pods turn from green to brown
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Gray-green turns to yellow to brown in fall
<b>FORM</b>	Symmetrical, rounded crown, upright-arching branches	<b>BARK</b>	Ornamental, amber to copper color, shiny and exfoliating in curls

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'MaackiaNificent' is slightly larger, with a spike-like racemes of white flowers and silvery-green foliage, known for being vigorous
<b>TOLERATES</b>	Drought, salt, pollution		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

### NOTES & LIMITATIONS

This small, adaptable species may have limited availability, but is a good selection for small, urban areas and landscapes alike.

## THORNLESS OSAGE ORANGE

*Maclura pomifera var. inermis*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

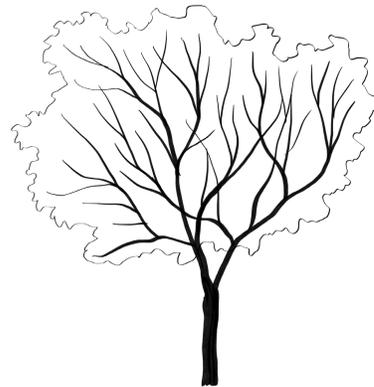
<b>HEIGHT</b>	20-50'	<b>FLOWER</b>	Green, hairy, petal-less flowers in short cylindrical clusters
<b>WIDTH</b>	20-50'	<b>FRUIT</b>	Fruitless
<b>GROWTH</b>	Fast	<b>FOLIAGE</b>	Bright, glossy green turn to yellow-green or golden in fall
<b>FORM</b>	Rounded with several low, prominent limbs and upward-arching branches	<b>BARK</b>	Attractive, orange inner bark visible through exfoliating gray-brown outer bark

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Wichita' (male) has an upright-spreading form with a dense canopy; 'Whiteshield' (male) has an upright oval form
<b>TOLERATES</b>	Drought, heat, salt		
<b>TRANSPLANT</b>	Easy B&B		

### NOTES & LIMITATIONS

This adaptable native species is often met with apprehension, due to its thorns and large, messy fruit; the selection of fruitless, thornless male forms is strongly recommended.





# FLOWERING CRABAPPLE

*Malus spp.*

## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun for best flowering	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	10-25'	<b>FLOWER</b>	Varies by cultivar
<b>WIDTH</b>	10-25'	<b>FRUIT</b>	Cherry-like
<b>GROWTH</b>	Varies	<b>FOLIAGE</b>	Varies by cultivar
<b>FORM</b>	Rounded	<b>BARK</b>	Varies by cultivar

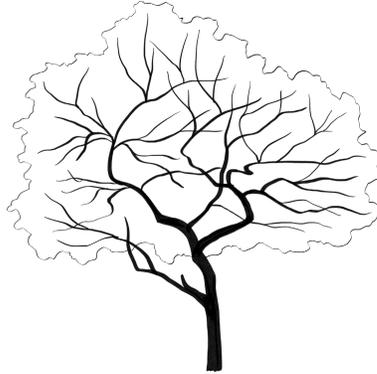
## PLANTING CONSIDERATIONS

<b>PESTS</b>	Cultivars listed show great resistance to pests that species is highly susceptible to: cedar-apple rust, mildew, scab, and fire-blight	<b>CULTIVARS</b>	Numerous, with many new selections added each year; several highly disease-resistant cultivars: Royal Raindrops®, Centurion®, 'Centzam', 'Donald Wyman', 'Harvest Gold®', 'Hargozam', 'Prairie-fire', Sugar Tyme® 'Sutyzam'
<b>TOLERATES</b>	Drought, salt		

**TRANSPLANT** Easy B&B or ≤2" caliper BR

## NOTES & LIMITATIONS

This species is well-known for its beautiful spring flowers, but is often discarded due to its susceptibility to numerous insects and diseases. The use of new, resistant cultivars is strongly recommended. Fruit can be a litter issue on older varieties.



# DAWN REDWOOD

*Metasequoia glyptostroboides*

## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

## CHARACTERISTICS

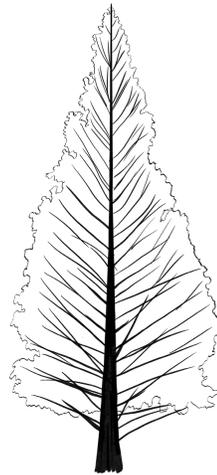
<b>HEIGHT</b>	70-100'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	25-50'	<b>FRUIT</b>	Small pendulous cones
<b>GROWTH</b>	Fast	<b>FOLIAGE</b>	Bright green needles turn to pinkish-brown to reddish-bronze in fall
<b>FORM</b>	Uniformly pyramidal and feathery, horizontal branching, base becomes buttressed with age	<b>BARK</b>	Red-brown in youth turns darker and fissured at maturity, slightly exfoliating

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Mites can cause defoliation under drought conditions	<b>CULTIVARS</b>	'National' and 'Sheridan Spire' are more narrowly upright than species, but 'National' may be more susceptible to canker problems than species
<b>TOLERATES</b>	Flooding, pollution, poor drainage		
<b>TRANSPLANT</b>	Easy B&B		

## NOTES & LIMITATIONS

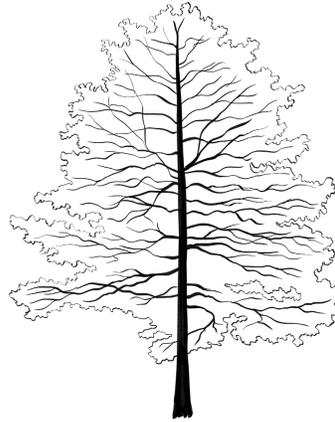
This deciduous conifer is best suited for large landscapes. Fairly adaptable, it is reportedly sensitive to salt, and may have limited availability.





## BLACK GUM

*Nyssa sylvatica*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates only occasional periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	30-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	20-40'	<b>FRUIT</b>	Inconspicuous blue-black drupes in pairs or clusters on female trees
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Glossy green in summer turns to brilliant yellow-orange-red-purple
<b>FORM</b>	Pyramidal in youth, varies in maturity between a pyramidal or rounded form	<b>BARK</b>	Dark gray to brown, scaly texture to irregular, block-like ridges

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	Afterburner® 'David Odom' and Firestarter® 'JFS-red' have a symmetrical, upright branching structure good for street-use; Green Gable™ 'NSUHH' and Red Rage® 'Haymanred' have a more broadly pyramidal form, shows leaf spot resistance
<b>TOLERATES</b>	Flooding, pollution, poor drainage		
<b>TRANSPLANT</b>	Difficult, small caliper B&B recommended, slow to establish		

### NOTES & LIMITATIONS

Named the Society of Municipal Arborists' 2008 Urban Tree of the Year, this native species provides excellent fall foliage, but is sensitive to drought, and may have limited availability.

## AMERICAN HOPHORNBEAM

*Ostrya virginiana*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

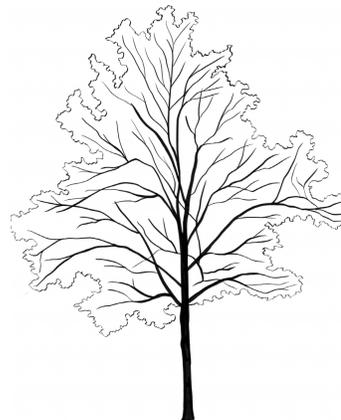
<b>HEIGHT</b>	25-40'	<b>FLOWER</b>	Female is inconspicuous but visible in spring, male has worm-like, yellow-brown catkins visible in winter
<b>WIDTH</b>	20-40'	<b>FRUIT</b>	Small, green turning to tan, hop-like pods in hanging clusters
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark green turns to yellow-brown to red in fall, drop early
<b>FORM</b>	Oval to pyramidal in youth, oval to rounded with upright, spreading branches at maturity	<b>BARK</b>	Ornamental grayish-brown, exfoliating

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Two-lined chestnut borer can be serious for stressed trees	<b>CULTIVARS</b>	Autumn Treasure® 'JFS-KWS' has more predictable upright narrow form, making it more suited for street-use
<b>TOLERATES</b>	Pollution		
<b>TRANSPLANT</b>	Difficult B&B or BR, slow to establish		

### NOTES & LIMITATIONS

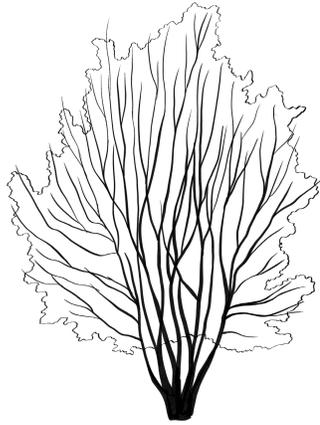
Named the Society of Municipal Arborists' 2019 Urban Tree of the Year, this adaptable species may have limited availability.





## PERSIAN PARROTIA

*Parrotia persica*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade (fall color best in full sun)	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Showy maroon stamens bloom early
<b>WIDTH</b>	15-30'	<b>FRUIT</b>	Dry brown capsules
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Emerging reddish-purple, green turns to yellow-orange-red mix
<b>FORM</b>	Broadly pyramidal to rounded with low branches, varying from horizontal to upright-ascending	<b>BARK</b>	Ornamental, exfoliates to expose gray-green-white-brown pattern

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Japanese beetle	<b>CULTIVARS</b>	'Ruby Red' has narrow, upright form and red foliage spring through fall; 'Persian Spire™' 'JL Columnar' is strongly upright and narrow, good for street-use; 'Vanessa' is tighter, denser, more upright, Society of Municipal Arborists' 2014 Urban Tree of the Year
<b>TOLERATES</b>	Drought, heat		
<b>TRANSPLANT</b>	Easy B&B, BR, or CG		

### NOTES & LIMITATIONS

Also known as Persian Ironwood, this species boasts both ornamental value and adaptability to adverse conditions. May be vulnerable to mechanical damage.

## SERBIAN SPRUCE

*Picea omorika*

### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

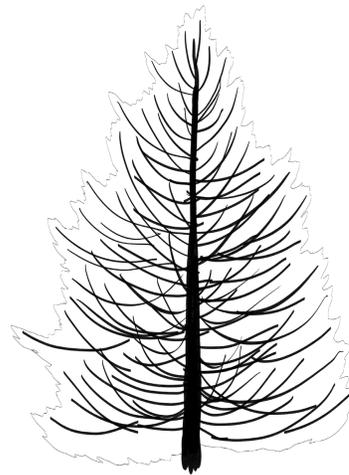
<b>HEIGHT</b>	50-60'	<b>FLOWER</b>	Inconspicuous
<b>WIDTH</b>	20-25'	<b>FRUIT</b>	Pendulous cones, purple turn to cinnamon-brown at maturity
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Glossy, dark green needles year round
<b>FORM</b>	Narrowly pyramidal, gracefully arching branching	<b>BARK</b>	Dark black-brown with thin, peeling scales

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Borers and aphids are occasionally an issue	<b>CULTIVARS</b>	'Nana' has a broad pyramid form; 'Pendula' has dramatic, drooping branches with an open form; 'Pendula Bruns' has a narrow, strongly weeping form and blueish-green needles
<b>TOLERATES</b>	Pollution		
<b>TRANSPLANT</b>	B&B recommended		

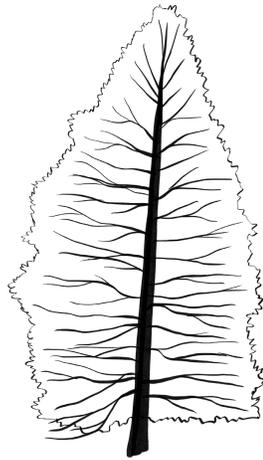
### NOTES & LIMITATIONS

One of the most adaptable spruce trees, this evergreen is noted for its excellent foliage. Does best when protected from strong winter winds.



# SWISS STONE PINE

*Pinus cembra*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	30-40'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	15-25'	<b>FRUIT</b>	Purplish-brown cones
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Blue-green to light green needles
<b>FORM</b>	Narrowly columnar, dense, uniform	<b>BARK</b>	New stems covered with orange-brown hairs

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	'Nana' has a pyramidal habit, grows to be 20' tall; 'Columnaris' has a dense, narrow fastigate form
<b>TOLERATES</b>	-		
<b>TRANSPLANT</b>	Easy B&B		

## NOTES & LIMITATIONS

This evergreen, although it may have limited availability, transplants easily and makes a good accent tree in the landscape.

# LONDON PLANETREE

*Platanus x acerifolia*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

## CHARACTERISTICS

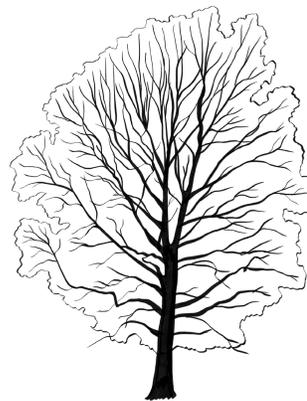
<b>HEIGHT</b>	70-100'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	65-80'	<b>FRUIT</b>	Pairs hang on long stalks, turns from green to brown, persists through winter
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Medium to dark green turns to yellow-brown in fall
<b>FORM</b>	Pyramidal in youth, open, spreading, rounded at maturity	<b>BARK</b>	Ornamental, exfoliates in plates to reveal attractive mix of tan & olive

## PLANTING CONSIDERATIONS

<b>PESTS</b>	A tough tree, but overuse has encouraged issues: plum borer, sycamore lacebug, canker stain, anthracnose, powdery mildew	<b>CULTIVARS</b>	'Columbia' and 'Liberty' resistant to anthracnose & powdery mildew; 'Bloodgood' resistant to anthracnose; 'Exclamation™' 'Morton Circle' resistant to anthracnose, powdery mildew, and frost cracking
<b>TOLERATES</b>	Drought, flooding, pollution, poor drainage		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

## NOTES & LIMITATIONS

Result of a cross between *P. orientalis* and *P. occidentalis*, this large, adaptable species may be over-planted. Can tolerate tough sites, but fruit can be a litter issue, and its roots may heave sidewalks.





# ACCOLADE CHERRY

*Prunus 'Accolade'*

## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Showy, pink
<b>WIDTH</b>	15-25'	<b>FRUIT</b>	Red drupe
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Medium green turns to good yellow, orange, or red in early fall
<b>FORM</b>	Open, rounded to vase-shaped, spreading	<b>BARK</b>	Ornamental, smooth and striated light gray

## PLANTING CONSIDERATIONS

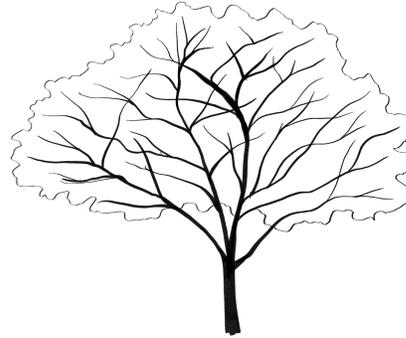
<b>PESTS</b>	Reportedly more resistant to the many pests that species is susceptible to	<b>CULTIVARS</b>	Information is cultivar-specific
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**TOLERATES** Salt

**TRANSPLANT** Easy BR

## NOTES & LIMITATIONS

A hybrid between *P.sargentii* and *P.subhirtella*, 'Accolade' is valued for its pest resistance and showy flowers.



# WHITE OAK

*Quercus alba*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

## CHARACTERISTICS

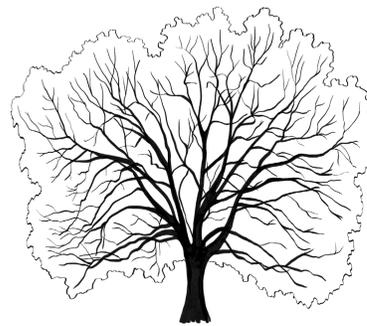
<b>HEIGHT</b>	45-80'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	45-80'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark blue-green to green turn to red or purple-red in late fall
<b>FORM</b>	Pyramidal in youth, rounded to oval-rounded at maturity with wide-spreading branches	<b>BARK</b>	Ornamental, light ashy-brown, develops small scaly plates with age

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to gypsy moth, two-lined chestnut borer, scale, galls, cankers; shows oak wilt resistance	<b>CULTIVARS</b>	<i>Q. alba</i> x <i>Q. robur</i> : Crimson Spire™ 'Crimschmidt' has a narrow form, tolerates a wide range of conditions, has good red fall color; Streetspire® 'JFS-KW1QX' has a narrow, columnar form, is powdery mildew resistant, has good red fall color
<b>TOLERATES</b>	Salt, poor drainage		
<b>TRANSPLANT</b>	Difficult		

## NOTES & LIMITATIONS

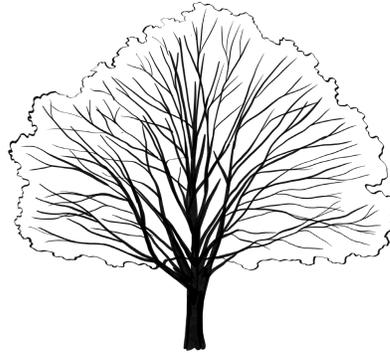
This large native species is highly valued in the landscape for its majestic appearance and adaptability. However, it is notably difficult to transplant, and it is recommended to do so when the tree is young.





## SWAMP WHITE OAK

*Quercus bicolor*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	45-70'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	45-60'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Lustrous dark green turns to yellow or red-purple in fall
<b>FORM</b>	Pyramidal in youth, broad, rounded, open at maturity	<b>BARK</b>	Ornamental dark gray-brown, flaky, deeply furrowed and ridged

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to gypsymoth, orange-striped oakworm, anthracnose, canker, powdery mildew	<b>CULTIVARS</b>	Regal Prince® 'Long' and Rosehill® 'Asjes' have narrow oval habit, grow to be 20' wide, and are highly mildew resistant
<b>TOLERATES</b>	Drought, flooding, salt, pollution, poor drainage		
<b>TRANSPLANT</b>	Moderately easy B&B or ≤2" caliper BR		

### NOTES & LIMITATIONS

Named the Society of Municipal Arborists' 1998 Urban Tree of the Year, this species is more adaptable and easier to transplant than *Q. alba*. Its lower branches may require pruning for street use, acorns can be a litter issue, and it may exhibit chlorosis when growing in alkaline soil, therefore is typically recommended for large, naturalized areas. Although climate change projections show a potential for a partial loss of habitat suitability for this species in Massachusetts, it may be able to adapt.

## SCARLET OAK

*Quercus coccinea*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

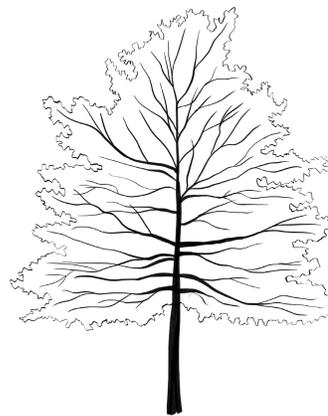
<b>HEIGHT</b>	60-75'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	40-50'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Glossy dark green turns to excellent russet to scarlet in fall, persist through winter, especially on young trees
<b>FORM</b>	Rounded and open, upright spreading branches	<b>BARK</b>	Grayish brown with furrows and ridges

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to gypsymoth, two-lined chestnut borer,	<b>CULTIVARS</b>	-
<b>TOLERATES</b>	Drought		
<b>TRANSPLANT</b>	Difficult, B&B or CG recommended		

### NOTES & LIMITATIONS

An attractive, adaptable oak, this species may have limited availability due to its difficulty to transplant. Acorns may be a litter issue.





## SHINGLE OAK

*Quercus imbricaria*

### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

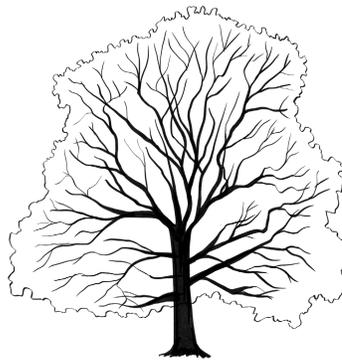
<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	40-65'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Emerging reddish, glossy dark green turns to yellow-brown or russet-red in fall, persists through winter
<b>FORM</b>	Pyramidal in youth, oval-rounded at maturity, upright, spreading branches, lower branches descending	<b>BARK</b>	Gray-brown, shallow furrows and ridges

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to gypsy moth, anthracnose, canker, rust, powdery mildew, wilt, galls	<b>CULTIVARS</b>	-
<b>TOLERATES</b>	Flooding, salt, shearing		
<b>TRANSPLANT</b>	Moderately easy B&B or BR, slow to establish		

### NOTES & LIMITATIONS

This adaptable species is reportedly easier to transplant than other oaks, and its acorns pose less risk of becoming a litter issue.



## BUR OAK

*Quercus macrocarpa*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

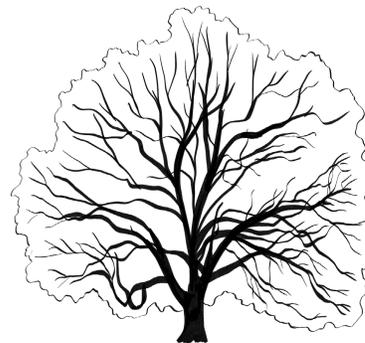
<b>HEIGHT</b>	60-80'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	60-90'	<b>FRUIT</b>	Acorns, heavy crop every 3-5 years
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark green turns to yellow-green or yellow-brown in fall
<b>FORM</b>	Pyramidal to oval in youth, rounded and open with age	<b>BARK</b>	Gray-brown, develops deep ridges and furrows

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to gypsy moth, two-lined chestnut borer, anthracnose, webworm, leaf miner	<b>CULTIVARS</b>	Urban Pinnacle™ 'JFS-KW3' has a narrow-pyramidal habit, resistant to anthracnose and mildew, smaller acorns create less of a litter issue; Jordan Street® 'Atwood' is upright and spreading with a rounded crown and mildew-resistant leaves
<b>TOLERATES</b>	Drought, flooding, poor drainage		
<b>TRANSPLANT</b>	Difficult, young trees B&B or CG recommended		

### NOTES & LIMITATIONS

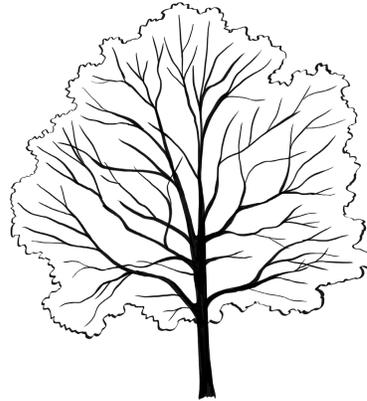
More adaptable to adverse conditions than most other oaks, this species was named the Society of Municipal Arborists' 2001 Urban Tree of the Year. Acorns can be a litter issue.





## CHESTNUT OAK

*Quercus montana*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	60-70'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	60-70'	<b>FRUIT</b>	Dark brown acorns, in pairs
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Dark green turns to orange-yellow to reddish or yellowish brown in fall
<b>FORM</b>	Pyramidal in youth, rounded to vase-shaped at maturity with large spreading branches	<b>BARK</b>	Ornamental, blackish brown, deeply furrowed at maturity, corky appearance

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to scale, two-lined chestnut borer, mites	<b>CULTIVARS</b>	-
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**TOLERATES** Drought

**TRANSPLANT** Moderately difficult

### NOTES & LIMITATIONS

More adaptable to adverse conditions than most other oaks, this species was named the Society of Municipal Arborists' 2017 Urban Tree of the Year. Flowers can be a litter issue.

## CHINKAPIN OAK

*Quercus muehlenbergii*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	35-50'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	35-60'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow-medium	<b>FOLIAGE</b>	Glossy dark yellow-green turns to yellow or orange-brown in fall
<b>FORM</b>	Open, rounded	<b>BARK</b>	Light gray, flaky

### PLANTING CONSIDERATIONS

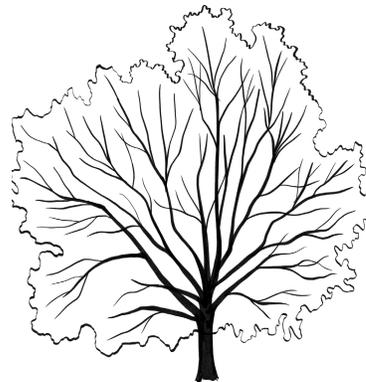
<b>PESTS</b>	Susceptible to gypsy moth, leaf miners, orange-striped oak worm, acorn weevils	<b>CULTIVARS</b>	-
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**TOLERATES** Drought, salt

**TRANSPLANT** Difficult, B&B recommended

### NOTES & LIMITATIONS

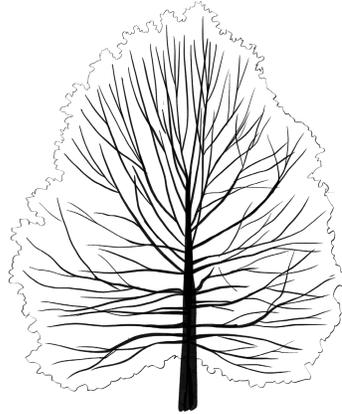
More adaptable to adverse conditions than most other oaks, this species was named the Society of Municipal Arborists' 2009 Urban Tree of the Year. Acorns can be a litter issue.





## PIN OAK

*Quercus palustris*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4A	<b>SOIL PH</b>	≤6.5
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	60-70'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	60-70'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Glossy dark green turns to russet-red in fall, young trees hold leaves through winter
<b>FORM</b>	Pyramidal in youth, oval at maturity with upright upper branches, horizontal middle branches, and descending lower branches	<b>BARK</b>	Smooth gray-brown, shallow ridges and furrows at maturity

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Overuse has encouraged issues: gypsy moth, wilt, galls, cankers; resistant to anthracnose	<b>CULTIVARS</b>	Green Pillar® 'Pringreen' has a columnar form, grows to be 50' x 15'
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**TOLERATES** Drought, flooding, poor drainage

**TRANSPLANT** Easy B&B, moderately difficult BR

### NOTES & LIMITATIONS

Possibly already over-planted, due to its ease of growing and transplanting compared to other oaks, this species requires a bit of maintenance for street use; pruning of lower branches may be required, acorns can be a litter issue, it is reportedly sensitive to salt, and it may exhibit chlorosis when growing in alkaline soil.

## WILLOW OAK

*Quercus phellos*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	6A	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	30-60'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Dark green turns to variable brown-yellow, or orange-yellow in fall, persists through winter
<b>FORM</b>	Pyramidal in youth, rounded at maturity with dense crown	<b>BARK</b>	Gray-brown, shallow ridges and furrows

### PLANTING CONSIDERATIONS

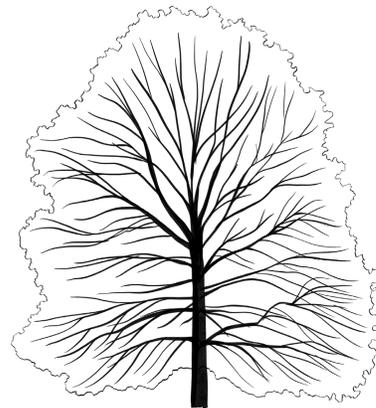
<b>PESTS</b>	Susceptible to gypsy moth, borers, scale, orange-striped oakworm; resistant to anthracnose	<b>CULTIVARS</b>	'Hightower' has a uniform, dense form, 55' x 30', mite resistant; 'Upperton' grows to be 60' x 30'
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**TOLERATES** Drought, flooding, heat, salt, poor drainage

**TRANSPLANT** B&B or BR recommended

### NOTES & LIMITATIONS

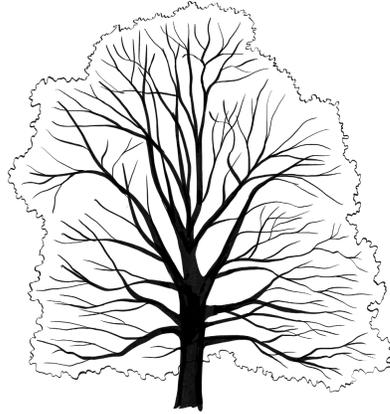
A popular street tree in the Southern US, this adaptable oak's lower branches may need pruning for street use, acorns may be a litter issue certain years, and it may exhibit chlorosis when growing in alkaline soil.





# ENGLISH OAK

*Quercus robur*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	40-60'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Dark green to blue-green, either drop green or turn to brown in fall
<b>FORM</b>	Pyramidal or oval in youth, broadly open and rounded at maturity	<b>BARK</b>	Grayish-black, deep furrows and ridges

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Powdery mildew may pose serious threat, anthracnose, gypsy moth	<b>CULTIVARS</b>	CrimsonSpire™ 'Crimschmidt', Attention! 'DTR 105', Streetspire® 'JFS-KW1QX', and Skymaster® 'Pyramich' are all reportedly powdery mildew resistant
<b>TOLERATES</b>	Drought, salt, pollution		
<b>TRANSPLANT</b>	B&B recommended		

### NOTES & LIMITATIONS

This adaptable, non-native oak is easier to transplant than *Q. macrocarpa* or *Q. alba*. Acorns can be a litter issue, and twig dieback may occur during harsh winters.

# SHUMARD OAK

*Quercus shumardii*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

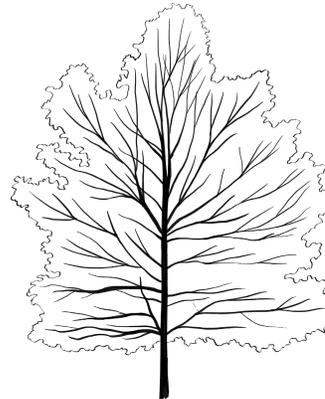
<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	40-65'	<b>FRUIT</b>	Acorns
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Dark green turns to yellow-bronze or red in fall
<b>FORM</b>	Pyramidal in youth, broadly oval to rounded at maturity	<b>BARK</b>	Gray-brown, developing somewhat platy ridges and furrows with age

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free, but susceptible to gypsy moth	<b>CULTIVARS</b>	-
<b>TOLERATES</b>	Drought, flooding, poor drainage		
<b>TRANSPLANT</b>	Easier than most oaks		

### NOTES & LIMITATIONS

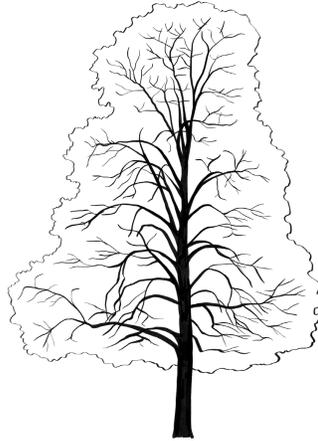
This species' extreme adaptability to adverse conditions and ease of transplanting make it a popular tree in the urban environment. Acorns can be a litter issue.





## COMMON SASSAFRAS

*Sassafras albidum*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤7.5
<b>LIGHT</b>	Prefers partial or full shade, tolerates full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	30-60'	<b>FLOWER</b>	Female trees have small, fragrant yellow flowers in clusters, males have inconspicuous flowers
<b>WIDTH</b>	25-40'	<b>FRUIT</b>	Blue-black, oval
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Bright green turns to brilliant yellow, orange, and red in fall
<b>FORM</b>	Pyramidal to irregular	<b>BARK</b>	Ornamental, dark cinnamon-brown, deeply ridged and furrowed

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to borers and bagworms	<b>CULTIVARS</b>	'Birch Mountain' has irregularly variegated leaves
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**TOLERATES** Flooding, poor drainage

**TRANSPLANT** Difficult, young trees CG recommended

### NOTES & LIMITATIONS

One of the best species for fall foliage, this species is best suited for naturalized areas. It is notably difficult to transplant, and it may have limited availability.

## JAPANESE UMBRELLA PINE

*Sciadopitys verticillata*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Prefers moist soil, avoid dry soil

### CHARACTERISTICS

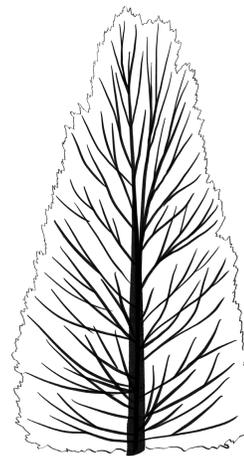
<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	15-20'	<b>FRUIT</b>	Upright, oval cones turn from green to brown at maturity
<b>GROWTH</b>	Very slow	<b>FOLIAGE</b>	Large, glossy dark green needles are not true leaves; true leaves hug branches and are small, scale-like and inconspicuous
<b>FORM</b>	Compact in youth, typically opens up with age, varying from broadly pyramidal to spire-like	<b>BARK</b>	Reddish-brown, exfoliates in plates and strips with age; ornamental but often not visible under dense foliage

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Generally pest-free	<b>CULTIVARS</b>	May be hard to find: 'Wintergreen' has very glossy, bright green needles, has a narrow conical habit; 'Pendula' has weeping branches; 'Aurea', 'Osorio Gold', and 'Ann Haddow' have golden yellow needles
<b>TOLERATES</b>	-		
<b>TRANSPLANT</b>	Difficult: B&B or CG recommended		

### NOTES & LIMITATIONS

Not a true pine, this evergreen species was named for its umbrella-like whorls of needles that provide a unique, ornamental addition to the landscape. It does best when protected from windy sites and late afternoon sun, and it may have limited availability.





## JAPANESE PA GODATREE

*Styphnolobium japonicum*

### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

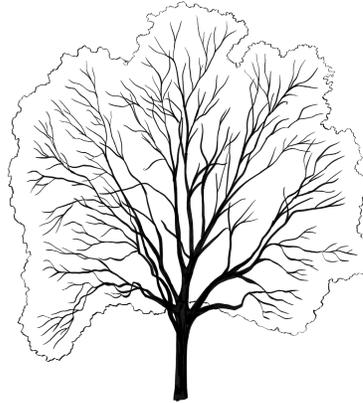
<b>HEIGHT</b>	50-70'	<b>FLOWER</b>	Showy, slightly fragrant, creamy white pea-like flowers in clusters, appear mid-summer
<b>WIDTH</b>	35-55'	<b>FRUIT</b>	Bright green pods turn to yellow-brown
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Lustrous, bright green in summer turns yellowish in late fall
<b>FORM</b>	Oval to rounded with upright spreading branches, dense	<b>BARK</b>	Light grayish-brown, becomes furrowed with age

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Stem canker possible in harsh winters	<b>CULTIVARS</b>	Regent® is fast growing, flowers at younger age, resistant to leaf-chewing insects; 'Columnaris' and 'Princeton Upright' have upright branching habits that are more tall than wide
<b>TOLERATES</b>	Drought, salt, pollution		
<b>TRANSPLANT</b>	Easy B&B		

### NOTES & LIMITATIONS

Also known as the Scholartree, this species is well suited to urban environments despite its fruit possibly being a litter issue and its susceptibility to branch breakage.



## JAPANESE TREE LILAC

*Syringa reticulata*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

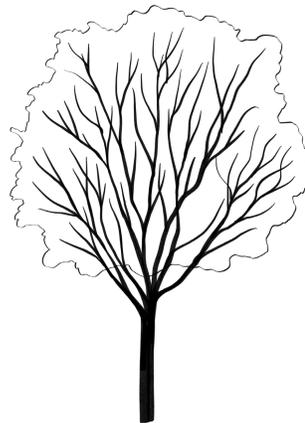
<b>HEIGHT</b>	20-30'	<b>FLOWER</b>	Showy, fragrant, cream colored pyramidal clusters; flowers best in full sun
<b>WIDTH</b>	15-25'	<b>FRUIT</b>	Tan capsules
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dark green, often nonexistent fall color, occasionally dull yellow
<b>FORM</b>	Oval	<b>BARK</b>	Ornamental, smooth reddish-brown, with horizontal lenticels

### PLANTING CONSIDERATIONS

<b>PESTS</b>	None serious; resistant to powdery mildew and scale	<b>CULTIVARS</b>	Regent™ 'PNI 5723', 'Summer Snow', and 'Ivory Silk' reportedly all have superior flower production and foliage, as well as a uniform form; 'Ivory Silk' named Society of Municipal Arborists' 1997 Urban Tree of the Year
<b>TOLERATES</b>	Drought, salt, pollution		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

### NOTES & LIMITATIONS

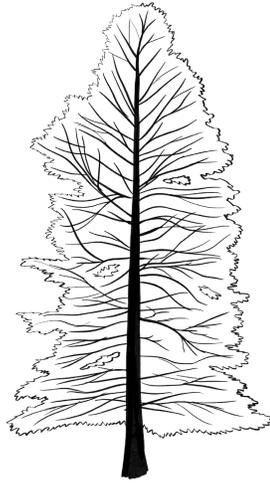
Reportedly the most adaptable lilac, this species makes a beautiful street tree. However, it has begun to cause concern related to invasive potential - recommended to not plant near natural settings where they could invade, and to monitor.





## BALDCYPRESS

*Taxodium distichum*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤7.0
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	50-70'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	20-40'	<b>FRUIT</b>	Small globe-shaped cones, green to purple turns to brown
<b>GROWTH</b>	Slow - medium	<b>FOLIAGE</b>	Emerging late in spring, soft green turns to brilliant orange-brown in fall
<b>FORM</b>	Columnar in youth, slender pyramidal at maturity with horizontal branches and a buttressed trunk	<b>BARK</b>	Attractive reddish-brown with narrow ridges

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to spider mites, forest tent caterpillar moth	<b>CULTIVARS</b>	Shawnee Brave® 'Michelson' is more narrow, shows mite resistance, and tolerates higher pH soils; 'Monarch of Illinois' is wide-spreading, and may be the most resistant to mites
<b>TOLERATES</b>	Drought, flooding, salt, pollution, poor drainage, wind damage		
<b>TRANSPLANT</b>	Difficult, B&B or CG recommended, slow to establish		

### NOTES & LIMITATIONS

Named the Society of Municipal Arborists' 2007 Urban Tree of the Year, this deciduous conifer is generally adaptable to adverse conditions, but may exhibit chlorosis when growing in alkaline soil.

## ARBOVITAE

*Thuja occidentalis*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

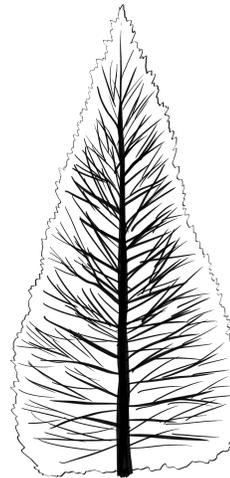
<b>HEIGHT</b>	40-60'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	10-15'	<b>FRUIT</b>	Small, brown to tan cones
<b>GROWTH</b>	Slow	<b>FOLIAGE</b>	Dense, rich green needles may turn to yellowish-green in winter
<b>FORM</b>	Narrow- to broadly-pyramidal	<b>BARK</b>	Gray to reddish-brown furrows

### PLANTING CONSIDERATIONS

<b>PESTS</b>	None serious, but susceptible to bagworm, heart rot, leaf miner, spider mites	<b>CULTIVARS</b>	'Degroot's Spire', 'Nigra', 'Pendula', 'Hetz Midget', 'Pumilia Sudworth' are all utility line compatible
<b>TOLERATES</b>	Pollution, poor drainage, shearing		
<b>TRANSPLANT</b>	B&B or CG recommended		

### NOTES & LIMITATIONS

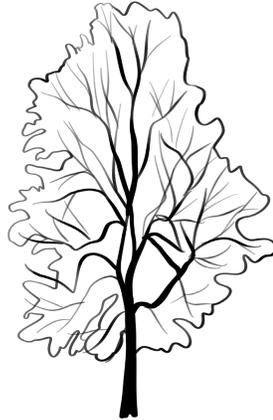
Also known as White Cedar, this popular evergreen is both attractive and adaptable, although it may be susceptible to deer browse and branch breakage. Although climate change projections show a potential for a partial loss of habitat suitability for this species in Massachusetts, it may be able to adapt.





## AMERICAN LINDEN

*Tilia americana*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry and saturated soil

### CHARACTERISTICS

<b>HEIGHT</b>	60-80'	<b>FLOWER</b>	Small, fragrant creamy-yellow blooms held in drooping clusters
<b>WIDTH</b>	20-40'	<b>FRUIT</b>	Whitish-yellow, fuzzy, hard-shelled nutlets
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Dark green turns to yellow-green in fall at best
<b>FORM</b>	Pyramidal in youth, oval-rounded with arched, spreading branches at maturity	<b>BARK</b>	Gray to brown, smooth in youth, furrowed with flat ridges at maturity

### PLANTING CONSIDERATIONS

<b>PESTS</b>	None serious, but susceptible to linden mites, Japanese beetles, aphids	<b>CULTIVARS</b>	'Lincoln' has an upright, compact form with good yellow fall color; American Sentry® 'McKSentry' has a pyramidal, symmetrical form; 'Redmond' is common, densely branched, named Society of Municipal Arborists' 2000 Urban Tree of the Year
<b>TOLERATES</b>	Flooding, poor drainage		
<b>TRANSPLANT</b>	Easy B&B		

### NOTES & LIMITATIONS

Also known as Basswood, this reportedly underutilized, beautiful native species may not be well suited to tough urban sites, as it is sensitive to salt and pollution and may be susceptible to branch breakage, but makes a great addition to large sites in the landscape.

## LITTLELEAF LINDEN

*Tilia cordata*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	3B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

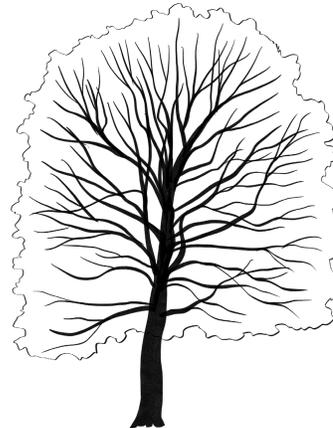
<b>HEIGHT</b>	50-70'	<b>FLOWER</b>	Yellowish flowers in loose drooping clusters attached to leaf-like bracts, fragrant
<b>WIDTH</b>	30-50'	<b>FRUIT</b>	Small, globose nutlets
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Dark green turns to yellow-green to yellow in fall
<b>FORM</b>	Pyramidal in youth, upright-oval to pyramidal-rounded at maturity, dense	<b>BARK</b>	Gray-brown, ridged and furrowed with age

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Aphids, Japanese beetles, and sooty mold can be serious issues	<b>CULTIVARS</b>	Greenspire® is popular due to its central leader and uniform branching; Corinthian® 'Corzam' has compact habit, with thicker, glossier foliage; Summer Sprite® 'Halka' grows to be 20' x 18'; good heat tolerance; 'Glenleven' is reportedly very cold hardy, but less dense
<b>TOLERATES</b>	Pollution, shearing		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

### NOTES & LIMITATIONS

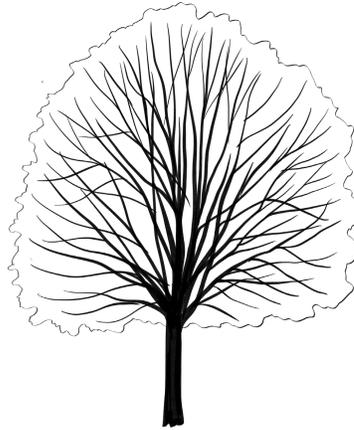
This species is much more commonly planted than *T. americana*, due to its adaptability to adverse conditions, although it may be susceptible to branch breakage.





# SILVER LINDEN

*Tilia tomentosa*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

## CHARACTERISTICS

<b>HEIGHT</b>	50-70'	<b>FLOWER</b>	Fragrant, yellowish-white drooping clusters attached to pale greenish-yellow bracts
<b>WIDTH</b>	25-55'	<b>FRUIT</b>	Small nutlets
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Glossy dark green with a silver underside turns to green-yellow or yellow in fall
<b>FORM</b>	Pyramidal in youth, pyramidal to upright-oval with age, dense and symmetrical	<b>BARK</b>	Smooth light gray in youth, gray-brown and furrowed with age

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Susceptible to various pests. CULTIVARS 'Sterling' is reportedly resistant to aphids can be serious issue; less susceptible to Japanese beetles than other <i>Tilia</i>	<b>TOLERATES</b>	Drought, heat, pollution, shearing
<b>TRANSPLANT</b>	Moderately difficult B&B or BR, slow to establish	<b>NOTES &amp; LIMITATIONS</b>	Noted as the most beautiful linden, this species is quite adaptable to adverse conditions, although it may have limited availability.

## NOTES & LIMITATIONS

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# AMERICAN ELM CULTIVARS

*Ulmus americana*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	Varies, 3B-5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

## CHARACTERISTICS

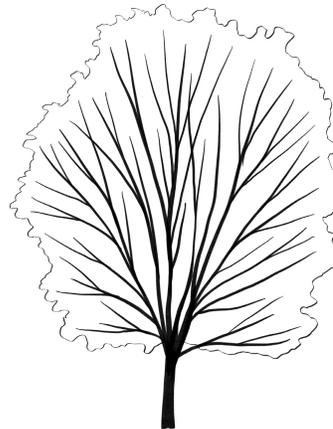
<b>HEIGHT</b>	60-80'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	30-60'	<b>FRUIT</b>	Small, greenish-yellow samaras
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Green to dark green turns to yellow in fall
<b>FORM</b>	Varies, often majestic and vase-shaped	<b>BARK</b>	Dark gray with broad, deep ridges

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Cultivars resistant to Dutch elm disease, elm yellows and elm leaf beetle resistance varies; susceptible to Asian longhorned beetle, cankers, aphids, powdery mildew	<b>CULTIVARS</b>	'New Harmony', 'Jefferson', 'Delaware #2', 'Princeton', and 'Valley Forge' reportedly have the most promising resistance, with the latter two cultivars being the most available in commerce
<b>TOLERATES</b>	Drought, flooding, salt, pollution, poor drainage	<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR

## NOTES & LIMITATIONS

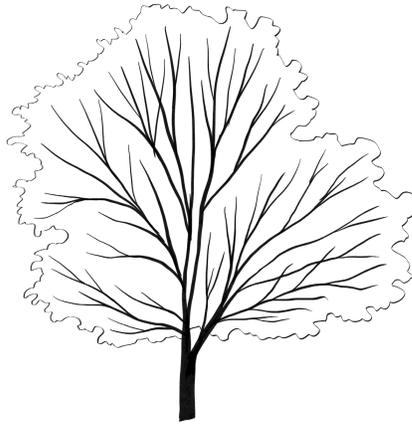
The beauty and adaptability of this native species is perhaps unmatched, however, extreme caution should be used when selecting due to the severity of pest issues and susceptibility to branch breakage caused by poor structure. New cultivars show promising pest resistance, and are strongly recommended to select over the species.





# LACEBARK ELM

*Ulmus parvifolia*



## ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade, shade	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	40-75'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	30-75'	<b>FRUIT</b>	Small, greenish-red disc-shaped samara
<b>GROWTH</b>	Medium - fast	<b>FOLIAGE</b>	Leathery dark green turns to variable yellow-brown or burgundy in fall
<b>FORM</b>	Rounded to vase-shape, branching varies; pendulous, upright-spreading, or horizontally-spreading	<b>BARK</b>	Ornamental, exfoliating to reveal gray, green, orange, and brown colors

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Shows resistance to elm leaf beetle, Japanese beetle, Dutch elm disease, and elm yellows	<b>CULTIVARS</b>	'Small Frye' is a smaller form, 18' x 25'; 'Everclear® BSNUPF' has upright, columnar form, 40' x 15'; 'Ailee® Emer II' resembles the American elm, 70' x 60', named Society of Municipal Arborists' 2003 Urban Tree of the Year
<b>TOLERATES</b>	Drought, flooding, salt, poor drainage		

**TRANSPLANT** Easy B&B

## NOTES & LIMITATIONS

Extreme adaptability, ornamental beauty, and resistance to pests make this species a great addition to a wide variety of sites.

# ELM HYBRIDS

*Ulmus x spp.*



## ENVIRONMENTAL CONDITIONS

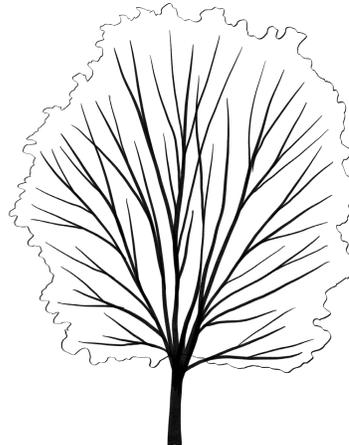
<b>ZONE</b>	Varies, 3B-5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

## CHARACTERISTICS

<b>HEIGHT</b>	50-70'	<b>FLOWER</b>	Inconspicuous
<b>WIDTH</b>	40-60'	<b>FRUIT</b>	Small, disc-shaped
<b>GROWTH</b>	Medium-fast	<b>FOLIAGE</b>	Medium to dark green turn to yellow in fall
<b>FORM</b>	Varies	<b>BARK</b>	Gray to brown, ridged or scaly

## PLANTING CONSIDERATIONS

<b>PESTS</b>	Listed cultivars are resistant to Dutch elm disease, resistance to elm yellows and elm leaf beetle varies	<b>CULTIVARS</b>	'New Horizon' is upright with a full crown; 'Patriot' is narrower than most elms, with an upright, vase-shaped form; 'Accolade™' 'Morton' has an American elm-like habit, glossy dark green foliage, Society of Municipal Arborists' 2012 Urban Tree of the Year
<b>TOLERATES</b>	Drought, flooding, salt, pollution, poor drainage		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		



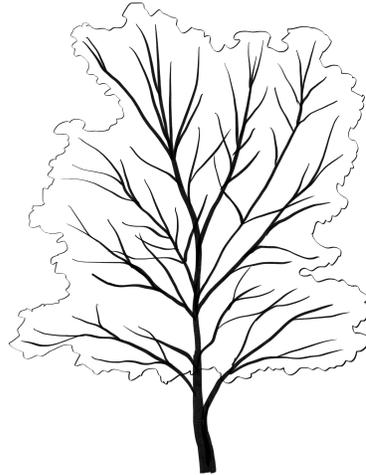
## NOTES & LIMITATIONS

Hybridization between different elm species has yielded pest resistance and adaptability to adverse conditions.



## SIELBOLD VIBURNUM

*Viburnum sieboldii*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	4B	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun, partial shade	<b>MOISTURE</b>	Tolerates occasional periods of dry soil

### CHARACTERISTICS

<b>HEIGHT</b>	15-20'	<b>FLOWER</b>	Showy, fragrant, flat clusters of small cream-colored flowers, can cover entire plant
<b>WIDTH</b>	10-15'	<b>FRUIT</b>	Showy oval drupes in clusters, red matures to black
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Dark green, occasionally turns to red or purple in fall, but often no fall color
<b>FORM</b>	Upright, open	<b>BARK</b>	Gray, alligator-like

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Not susceptible to Viburnum leaf beetle	<b>CULTIVARS</b>	'Seneca' is heavily flowering, fruit remains attractive for longer; 'Wavecrest' grows 10-12' x 6-8', bright red fall foliage; 'Ironclad™' 'KLMfour' is notably cold hardy, grows 15' x 12', dark burgundy fall foliage
<b>TOLERATES</b>	Shearing		
<b>TRANSPLANT</b>	Easy		

### NOTES & LIMITATIONS

Although this species does poorly in heat and drought conditions, it makes a highly ornamental addition to the landscape, sheared as a shrub or kept as a small tree.

## JAPANESE ZELKOVA

*Zelko vaserrata*



### ENVIRONMENTAL CONDITIONS

<b>ZONE</b>	5A	<b>SOIL PH</b>	≤8.2
<b>LIGHT</b>	Full sun	<b>MOISTURE</b>	Tolerates prolonged periods of dry soil

### CHARACTERISTICS

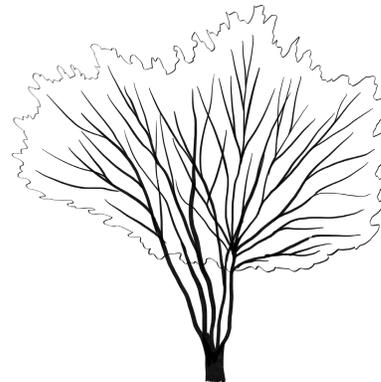
<b>HEIGHT</b>	50-80'	<b>FLOWER</b>	Not ornamentally important
<b>WIDTH</b>	40-60'	<b>FRUIT</b>	Not ornamentally important
<b>GROWTH</b>	Medium	<b>FOLIAGE</b>	Dark green turns to variable yellow, orange, red, bronze, purple mix in fall
<b>FORM</b>	Vase-shaped with upright arching branches and a short trunk	<b>BARK</b>	Ornamental, brown and smooth in youth, gray and exfoliating with age to expose orange inner bark

### PLANTING CONSIDERATIONS

<b>PESTS</b>	Japanese beetles feed on foliage, shows resistance to Dutch elm disease and bacterial canker	<b>CULTIVARS</b>	City Sprite™ grows to be 24' x 18'; Green Vase® has a graceful form and grows fast; 'Musashino' has an upright, narrow form that is good for tight planting areas, Society of Municipal Arborists' 2016 Urban Tree of the Year
<b>TOLERATES</b>	Drought, heat, salt, pollution		
<b>TRANSPLANT</b>	Easy B&B or ≤2" caliper BR		

### NOTES & LIMITATIONS

Similar, yet less impressive, in appearance to an elm tree. Boasts adaptability to adverse conditions and pest resistance. Makes a good street tree, although it may be susceptible to branch breakage.



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