

July 2019

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
of the requirements for the degree of

MASTER OF SCIENCE

May 2019

Environmental Conservation

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ABSTRACT

ECOLOGICAL CONSIDERATIONS AND APPLICATION OF URBAN TREE SELECTION IN MASSACHUSETTS

MAY 2019

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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.

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CHAPTER 1

INTRODUCTION

We've all heard it- 'right plant, right place'¹. 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^{2,3}, levels of airborne pollutants, air temperature⁴, stormwater runoff and flooding, and provide other critical ecological services². Trees contribute economically by boosting property values⁵ and fostering energy savings from nearby buildings⁴. Within cities, trees increase people's feelings of well-being, minimize noise, and reduce crime^{5,2,6}. Trees are a growing investment, and over time generate their benefits in greater magnitude as they increase in size and stature⁷.

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 million⁸. The average lifespan of a tree in downtown urban areas ranges from 19-28 years⁹, 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)¹⁰.

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^{15, 16, 17}. Tree growth is also affected by seasonal precipitation amount and form¹³, which, in Massachusetts, is predicted to decrease in summer and increase by 30% in the winter, primarily as rain¹⁸.

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 environments¹¹, which can inhibit root growth and limit the infiltration of moisture^{12, 13}. With the addition of vehicular and foot traffic, urban soils are often compacted, feature poor drainage, altered nutrient composition, and contamination¹⁴. The use of de-icing salt and materials containing limestone raise the pH of most urban soils, making them unfavorably alkaline¹⁴. The elevated levels of air pollution and temperature in urban environments also create unfavorable growing conditions¹⁴.

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 trees¹⁴.

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 conditions¹⁹. 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 century²⁰, 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 extinct¹⁹. 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 bees²¹. Non-native plants also present greater risks when planted, as they are 40x more likely to become invasive than native plants²². Invasive plants have the potential to displace native species, reduce biodiversity, and completely restructure an ecosystem (i.e., nutrient cycling, hydrology systems, fire regime)²³. 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.)²³. 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 US²⁴. Additionally, non-native plants can sustain pests and pathogens by providing previously unavailable feeding niches. Since many non-native plants are transported from warmer climates²⁴, 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 plants²¹; this includes not only taxpayer dollars, but homeowners who have to pay for tree removal or suffer diminished property value²⁴. A recommended management strategy is to plant less than 30% non-native species in the landscape²¹.

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 states²⁵. Ash trees are adaptable, native to Massachusetts, and make up a reported 5% of the state's street trees²⁶, meaning that 1 in 20 of our street trees could be lost in the next few years, all from a single insect species¹⁴. 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 stability²⁷. 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 monoculture²⁸.

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 family³⁰. 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 northeast¹⁴. 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 thuyoides</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)

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. ≤ 7.0 indicates species that do not tolerate alkaline soil, and can only tolerate soils pH from 5.0-7.0. ≤ 7.5 indicates species that moderately tolerate alkaline soil, or pH from 5.0-7.5, and ≤ 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

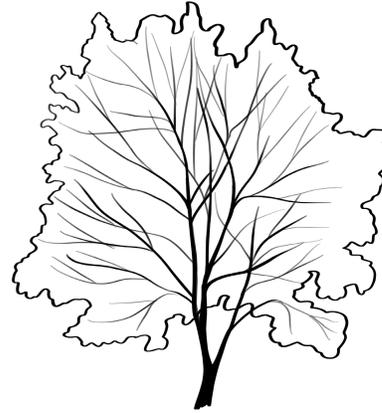


ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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



PLANTING CONSIDERATIONS

PESTS	Typically few, but susceptible to Asian longhorned beetle	CULTIVARS	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'
TOLERATES	Drought, heat, pollution		
TRANSPLANT	Moderately easy		

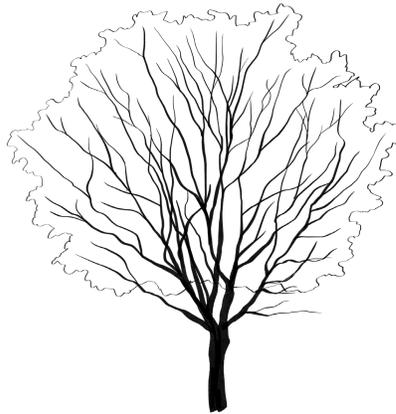
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Typically few, but susceptible to Asian longhorned beetle	CULTIVARS	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
TOLERATES	Drought, heat, pollution, poor drainage, shearing		
TRANSPLANT	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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

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

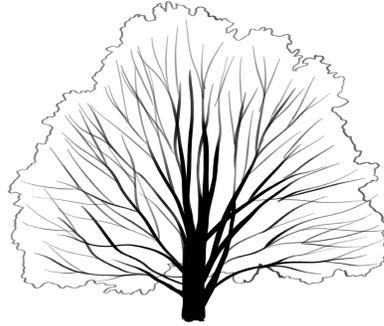
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Typically few, but susceptible to Asian longhorned beetle	CULTIVARS	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
TOLERATES	Drought		
TRANSPLANT	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

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

CHARACTERISTICS

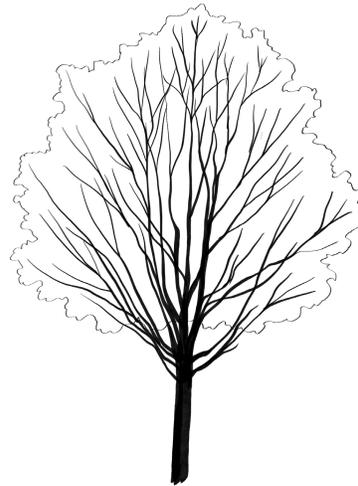
HEIGHT	40-60'	FLOWER	Showy reddish flowers in clusters, monoecious
WIDTH	30-70'	FRUIT	Samara, often red
GROWTH	Medium - fast	FOLIAGE	Medium green turns to variable, often excellent, yellow, orange, or red in early fall
FORM	Often pyramidal in youth, narrow upright to rounded at maturity	BARK	Ornamental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

PLANTING CONSIDERATIONS

PESTS	Verticillium wilt, leaf hoppers, borers, Asian longhorned beetle	CULTIVARS	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
TOLERATES	Pollution, flooding, poor drainage		
TRANSPLANT	Easy B&B or ≤2" caliper BR		

NOTES & LIMITATIONS

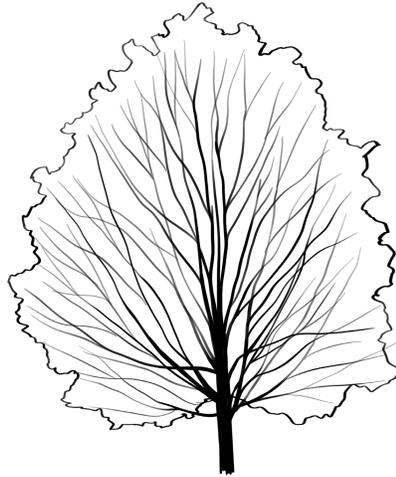
Although overplanted in Massachusetts, this adaptable maple can make a great addition to just about any large site. Traits, including cold hardiness, is heavily dependent on seed source. Chlorosis may be exhibited when growing in alkaline soils, and may be susceptible branch breakage. Although climate 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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Verticillium wilt, leaf scorch, Asian longhorned beetle	CULTIVARS	Many available: Apollo®, Fairview®, Fall Fiesta®, Green Mountain®, and Unity® are most cold hardy; Adirondak®, Crescendo™, Fiddler's Creek™, 'Legacy', and Steeple™ reportedly drought tolerant; 'Caddo' is extremely drought tolerant; 'Sugar Cone' grows only 25' x 13'
TOLERATES	-		
TRANSPLANT	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

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

CHARACTERISTICS

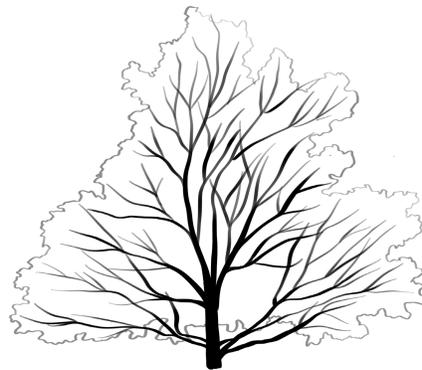
HEIGHT	25-30'	FLOWER	Bright yellow flowers emerge in spring before leaves
WIDTH	25-30'	FRUIT	Samara
GROWTH	Slow	FOLIAGE	Emerging purplish-red, glossy green leaves turn to yellow-orange and red in fall
FORM	Rounded with a broad crown and low branching tendency	BARK	Gray-brown, rough and fissured at maturity

PLANTING CONSIDERATIONS

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

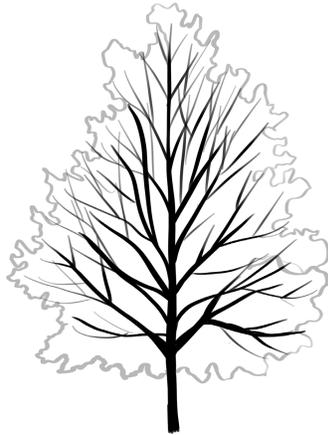
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Typically few, but susceptible to Asian longhorned beetle	CULTIVARS	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
TOLERATES	Flooding, poor drainage		
TRANSPLANT	Easy B&B or ≤2" caliper BR		

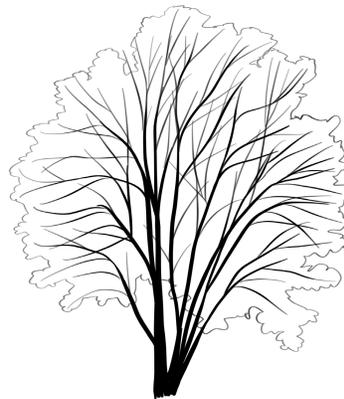
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	None serious, but susceptible to rusts, scales, aphids, mildews	CULTIVARS	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
TOLERATES	Poor drainage		
TRANSPLANT	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

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

CHARACTERISTICS

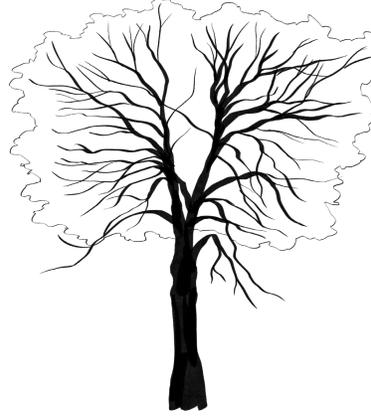
HEIGHT	30-50'	FLOWER	Upright pyramidal clusters of showy pink to red flowers
WIDTH	30-40'	FRUIT	Glossy brown nuts with slightly prickly husks
GROWTH	Slow	FOLIAGE	Dark green turns to brown in fall
FORM	Rounded to broad-rounded, oftendense	BARK	Dark gray-brown, potentially becoming platy and exfoliating

PLANTING C ONSIDERATIONS

PESTS	Fungal blight can cause browning leaves, less susceptible to leaf scorch, blotch, & mildew than <i>A. hippocastanum</i>	CULTIVARS	'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
TOLERATES	Variety of soil conditions		
TRANSPLANT	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

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

CHARACTERISTICS

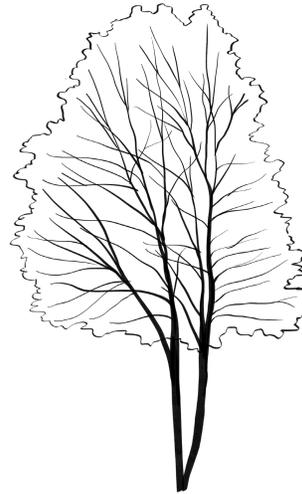
HEIGHT	40-70'	FLOWER	Catkins
WIDTH	40-60'	FRUIT	Inconspicuous, small nutlets inside catkins
GROWTH	Medium - fast	FOLIAGE	Medium green occasionally turns to yellow in fall
FORM	Pyramidal to oval in youth, rounded with maturity; often multi-stemmed	BARK	Ornamental; thin, shiny red-brown in youth, orange-brown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

PLANTING C ONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	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
TOLERATES	Flooding, heat, salt, poor drainage		
TRANSPLANT	Moderately difficult BR, easier B&B or CG		

NOTES & LIMITATIONS

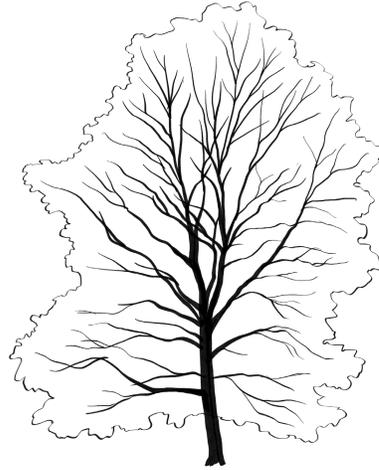
This ornamental, adaptable species can be used for sites along streams and naturalized areas, as well as urban sites. Leaves may prematurely drop under drought conditions, may be susceptible to branch breakage, and chlorosis may be exhibited when growing in alkaline soil.





COMMON HORNBEAM

Carpinus betulus



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free, but susceptible to Japanese beetle	CULTIVARS	'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
TOLERATES	Pollution, shearing		
TRANSPLANT	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

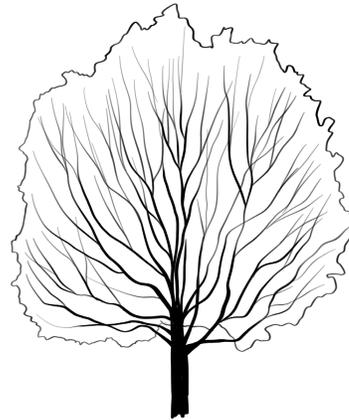
ZONE	3A	SOIL PH	≤7.5
LIGHT	Prefers partial shade, tolerates full sun and shade	MOISTURE	Tolerates occasional periods of dry and saturated soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	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
TOLERATES	Flooding, pollution, poor drainage, shearing		
TRANSPLANT	Difficult B&B and BR, slow to establish		



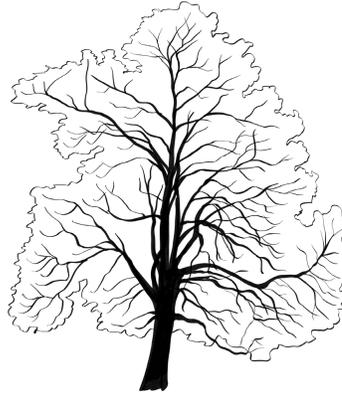
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Typically not serious, but susceptible to leaf spots, powdery mildew, twig blight, verticillium wilt	CULTIVARS	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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

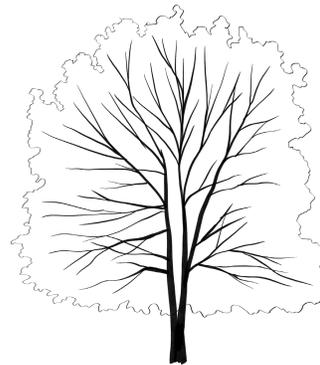
PESTS	None serious, but susceptible to mistletoe, scale, leaf spot; resistant to witches' broom & nipple gall	CULTIVARS	May have limited availability. 'All Seasons' is slightly smaller and faster growing; 'Magnifica' is a <i>C. occidentalis</i> and <i>C. laevigata</i> hybrid, yields little to no fruit, 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

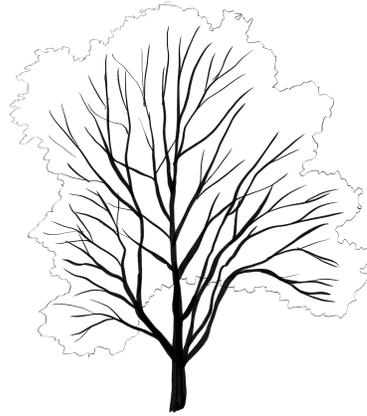
Although not known for its ornamental value, this native species is treasured for its adaptability to adverse conditions. Birds enjoy its fruit, which has a sweet, date-like taste.





COMMON HACKBERRY

Celtis occidentalis



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	None serious, susceptible to witches broom, nipple gall, powdery mildew	CULTIVARS	'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
TOLERATES	Drought, flooding, heat, pollution, poor drainage	TRANSPLANT	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

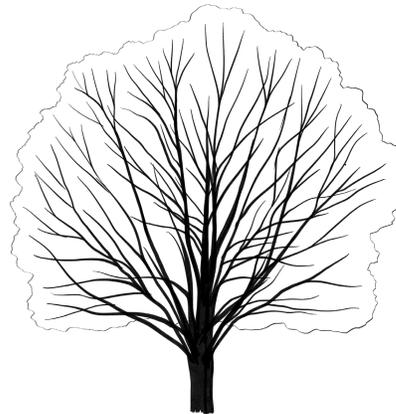
ZONE	4A	SOIL PH	≤8.2
LIGHT	Full sun, partial shade	MOISTURE	Tolerates only occasional periods of saturated soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Resistant to verticillium wilt	CULTIVARS	'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
TOLERATES	Flooding, poor drainage		
TRANSPLANT	Difficult		



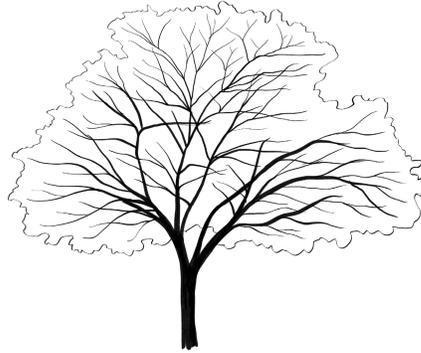
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Cankers and verticillium wilt can be serious when tree is stressed	CULTIVARS	'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
TOLERATES	Drought		
TRANSPLANT	&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

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

CHARACTERISTICS

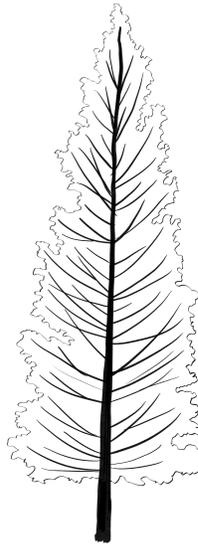
HEIGHT	40-60'	FLOWER	Not ornamentally important
WIDTH	10-20'	FRUIT	Small brown cones
GROWTH	Medium	FOLIAGE	Blueish-green needles turn bronze in winter and persist
FORM	Narrowly columnar	BARK	Light gray to reddish-brown, irregularly furrowed

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'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
TOLERATES	Flooding, poor drainage		
TRANSPLANT	Difficult BR		

NOTES & LIMITATIONS

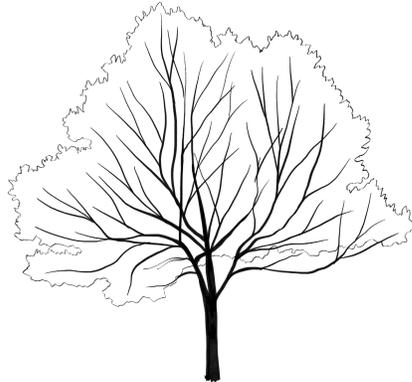
This native evergreen is especially useful for coastal or wet planting sites. It typically does best with protection from strong winds and deer browsing. Although climate change projections show a potential for a partial loss of habitat suitability for this species in Massachusetts, it may be able to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





WHITE FRINGETREE

Chionanthus virginicus



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'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
TOLERATES	Drought, flooding, poor drainage, pollution		
TRANSPLANT	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

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

CHARACTERISTICS

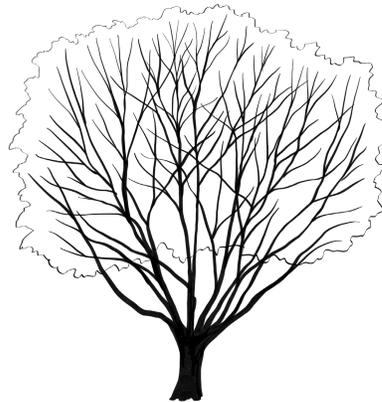
HEIGHT	30-50'	FLOWER	Clusters of fragrant, showy white pea-like flowers; blooms heavily every 2-3 years
WIDTH	40-55'	FRUIT	Flat seed pods, green ripens to brown in fall
GROWTH	Medium - fast	FOLIAGE	Bright green in summer turns to brilliant yellow in fall with sweet scent
FORM	Broad-rounded with low,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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

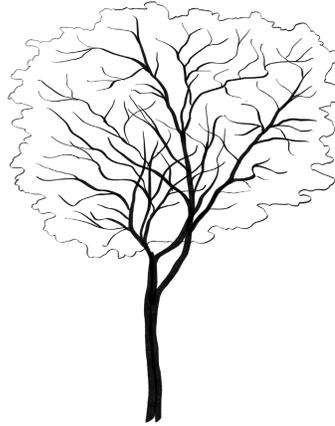
Named the Society of Municipal Arborists' 2015 Urban Tree of the Year, this native species makes an attractive addition to the landscape. It may be susceptible to branch breakage, and its thin bark is sensitive to damage and sun scald.





JAPANESE CLETHRA

Clethra barbinervis



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Mites can be an issue in hot, dry environments	CULTIVARS	First Snow® 'Takeda Nishiki' has variegated foliage and polished, tricolored bark
TOLERATES	Flooding, salt		
TRANSPLANT	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

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

CHARACTERISTICS

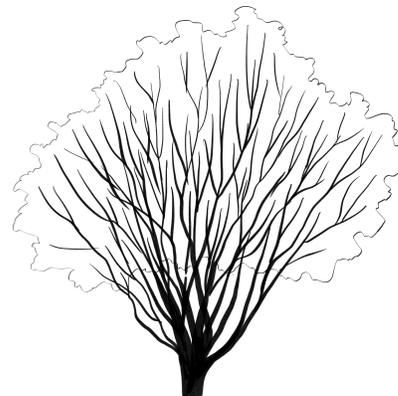
HEIGHT	15-30'	FLOWER	Small, greenish-yellow, upright flowers held by four large, showy creamy white bracts
WIDTH	15-30'	FRUIT	Potentially showy, red, raspberry-like, edible
GROWTH	Slow	FOLIAGE	Dark green turns to impressive deep red or red-purple
FORM	Vase-shaped with upright branches in youth, rounded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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

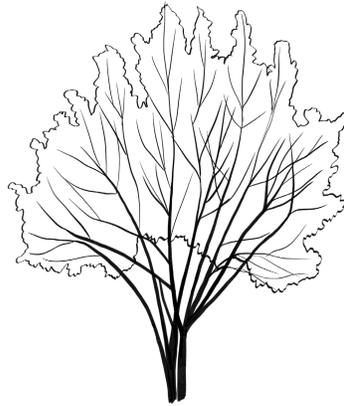
This ornamental species is less common in the landscape than *C. florida*, but is reportedly more adaptable to a variety of difficult soil conditions. May require pruning for street use.





CORNELIANCHERRY DOGWOOD

Cornus mas



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'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
TOLERATES	Salt		
TRANSPLANT	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

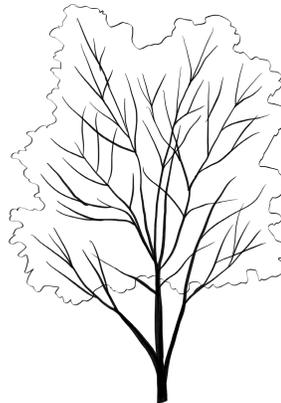
ZONE	5A	SOIL PH	≤7.5
LIGHT	Full sun, partial shade, shade	MOISTURE	Tolerates occasional periods of dry soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Resistant to dogwood anthracnose, powdery mildew and dogwood borer	CULTIVARS	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®
TOLERATES	-		
TRANSPLANT	Moderately easy		



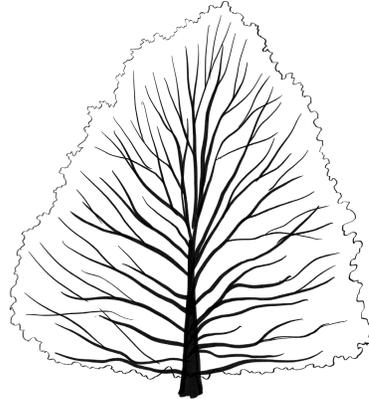
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Eastern filbert blight can occasionally be a serious issue	CULTIVARS	-
TOLERATES	Drought, heat, pollution		
TRANSPLANT BR	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

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

CHARACTERISTICS

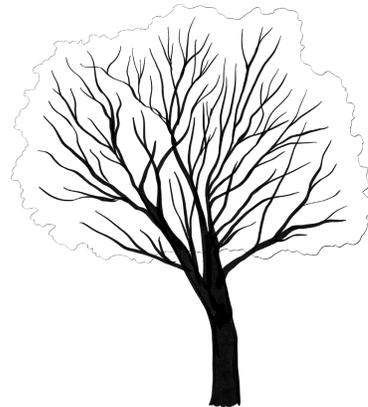
HEIGHT	20-30'	FLOWER	Green to purple pyramidal
WIDTH	15-30'	FRUIT	Often sparse, but attractive tan clusters; silky hairs give 'smoky' appearance
GROWTH	Medium	FOLIAGE	Emerging bright light green, blue-green turns to showy yellow-orange-red or red-purple in fall
FORM	Oval to rounded, low branching and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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

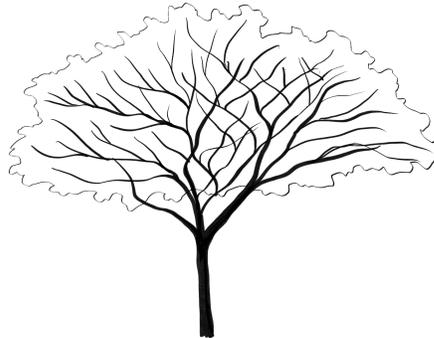
Although this native species' low branching may require pruning for street use, its impressive drought tolerance make it a promising choice for urban landscapes.





THORNLESS COCKSPUR HAWTHORN

Crataegus crus-galli var. *inermis*



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Susceptible to many-aphids, scales, fireblight, leaf blight, mildews, rusts	CULTIVARS	Crusader™ 'Cruzam' known for disease resistance, 15' x 15' wide
TOLERATES	Drought, heat, salt, pollution		
TRANSPLANT	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

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

CHARACTERISTICS

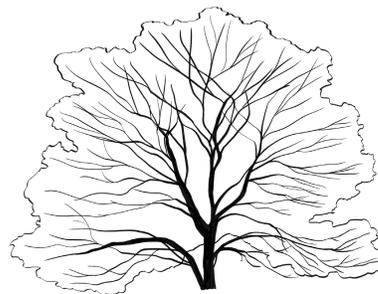
HEIGHT	20-30'	FLOWER	Showy white clusters
WIDTH	20-30'	FRUIT	Showy, bright red, persists through winter
GROWTH	Slow - medium	FOLIAGE	Glossy green turns to variable, yet excellent, fall color, often purple-red or gold
FORM	Rounded, vase-shaped branching	BARK	Thorny; ornamental, gray, exfoliates with age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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

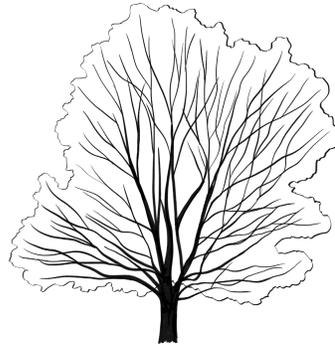
'Winter King' is the most common (and beloved) *C. viridis* cultivar, making a beautiful addition to the landscape. However, thorns should be considered in relation to planting location before selection.





HARDY RUBBER TREE

Eucommia ulmoides



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	Emerald Point™ 'Empozam' has a columnar to narrow oval form, with smaller, heavily textured leaves
TOLERATES	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

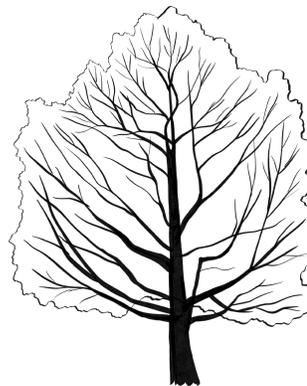
ZONE	4B	SOIL PH	≤8.2
LIGHT	Full sun	MOISTURE	Tolerates prolonged periods of dry soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'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
TOLERATES	Drought, heat, pollution, salt, wind and snow damage		
TRANSPLANT	Difficult BR, B&B recommended		



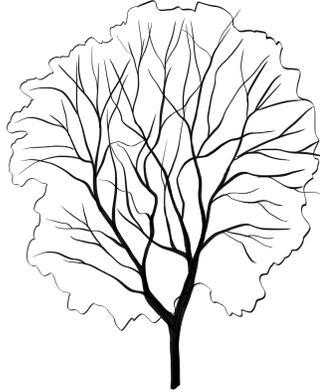
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Overuse has encouraged severe issues: borers, leaf spot, webworm, powdery mildew, cankers	CULTIVARS	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
TOLERATES	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

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

CHARACTERISTICS

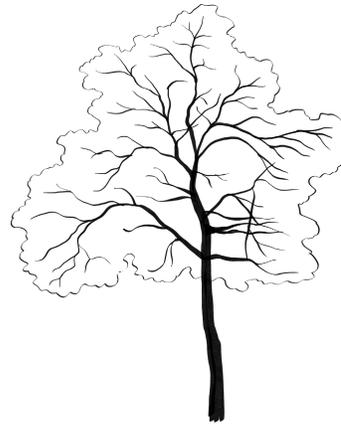
HEIGHT	50-75'	FLOWER	Greenish-white pyramidal clusters
WIDTH	40-50'	FRUIT	Leathery, brownish-black pods persist through winter
GROWTH	Medium	FOLIAGE	Emerging pinkish-purple, blue-green turns to potentially good fall yellow
FORM	Sparse branching in youth, oval to vase shaped at maturity, upward arching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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'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
TOLERATES	Drought, salt		
TRANSPLANT	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

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

CHARACTERISTICS

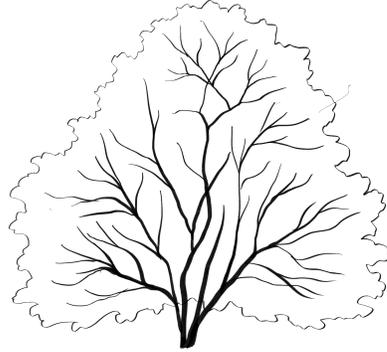
HEIGHT	20-40'	FLOWER	Showy white, bell-shaped and in clusters
WIDTH	20-35'	FRUIT	Oval with four wings
GROWTH	Medium	FOLIAGE	Dark green turns to yellow-green in fall
FORM	Rounded, low branches, often multi-stemmed; single-stemmed specimens are pyramidal to oval	BARK	Brown in youth, gray-brown-black and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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'UConn Wedding Bells' is more compact, heavier flowering; 'Rosy Ridge' and 'Arnold Pink' have beautiful pink flowers
TOLERATES	Salt, pollution		
TRANSPLANT	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

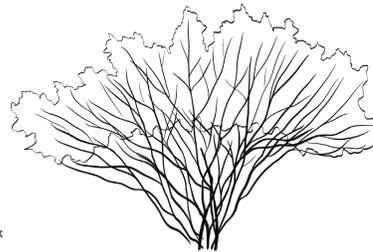
ZONE	3B	SOIL PH	≤7.0
LIGHT	Full sun, partial shade	MOISTURE	Tolerates only very occasional periods of dry soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

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



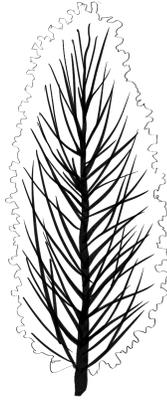
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Susceptible to mites, bagworms, phomopsis blight, cedar-apple rust	CULTIVARS	'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
TOLERATES	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

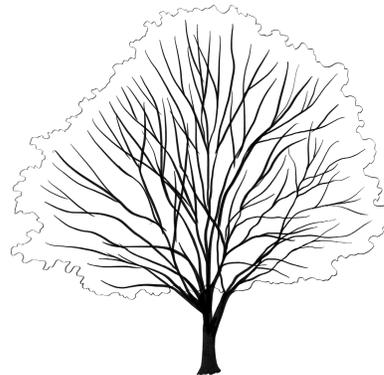
ZONE	5A	SOIL PH	≤8.2
LIGHT	Full sun	MOISTURE	Tolerates prolonged periods of dry soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

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



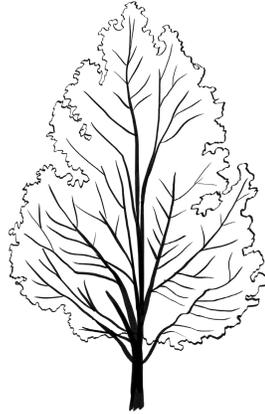
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	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
TOLERATES	Flooding, poor drainage		
TRANSPLANT	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

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

CHARACTERISTICS

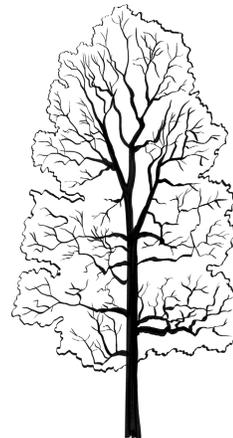
HEIGHT	70-90'	FLOWER	Tulip-shaped, yellow-green petals and orange base
WIDTH	35-50'	FRUIT	Cone-shaped clusters of woody samaras, persists through winter
GROWTH	Fast	FOLIAGE	Bright green turns to golden yellow in fall
FORM	Pyramidal in youth, oval-rounded at maturity	BARK	Ornamental, gray, furrowed with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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	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
TOLERATES	Flooding, poor drainage		
TRANSPLANT	Difficult B&B or BR, small caliper B&B recommended		

NOTES & LIMITATIONS

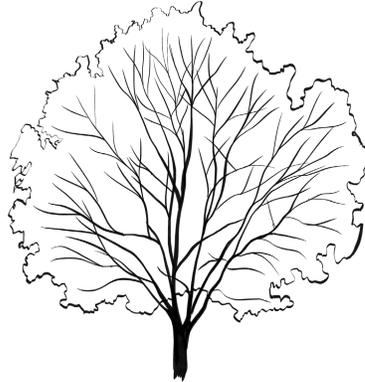
Named the Society of Municipal Arborists' 2018 Urban Tree of the Year, this species is sensitive to drought, and it may be susceptible to branch breakage, yet it still makes a great addition to almost any large, urban site.





AMUR MAACKIA

Maackia amurensis



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'MaackiaNificent' is slightly larger, with a spike-like racemose of white flowers and silvery-green foliage, known for being vigorous
TOLERATES	Drought, salt, pollution		
TRANSPLANT	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

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

CHARACTERISTICS

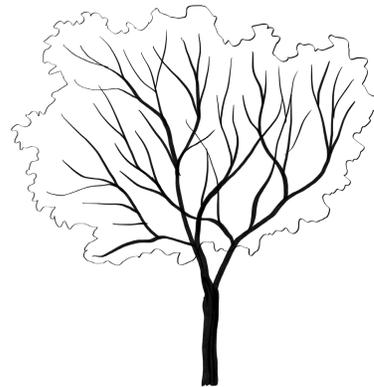
HEIGHT	20-50'	FLOWER	Green, hairy, petal-less flowers in short cylindrical clusters
WIDTH	20-50'	FRUIT	Fruitless
GROWTH	Fast	FOLIAGE	Bright, glossy green turn to yellow-green or golden in fall
FORM	Rounded with several low, prominent limbs and upward-arching branches	BARK	Attractive, orange inner bark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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

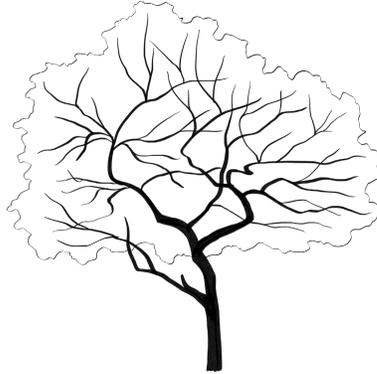
This adaptable native species is often met with apprehension, due to its thorns and large, messy fruit; the selection of fruitless, thornless male forms is strongly recommended.





FLOWERING CRABAPPLE

Malus spp.



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Cultivars listed show great resistance to pests that species is highly susceptible to: cedar-apple rust, mildew, scab, and fire-blight	CULTIVARS	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'
TOLERATES	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

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

CHARACTERISTICS

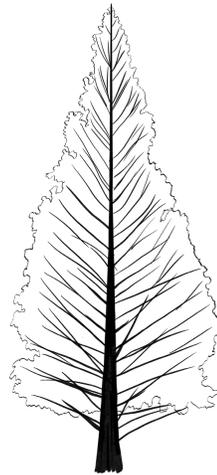
HEIGHT	70-100'	FLOWER	Not ornamentally important
WIDTH	25-50'	FRUIT	Small pendulous cones
GROWTH	Fast	FOLIAGE	Bright green needles turn to pinkish-brown to reddish-bronze in fall
FORM	Uniformly pyramidal and feathery, horizontal branching, base becomes buttressed with age	BARK	Red-brown in youth turns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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

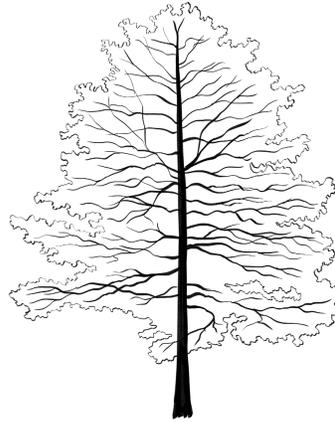
This deciduous conifer is best suited for large landscapes. Fairly adaptable, it is reportedly sensitive to salt, and may have limited availability.





BLACK GUM

Nyssa sylvatica



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	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
TOLERATES	Flooding, pollution, poor drainage		
TRANSPLANT	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

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

CHARACTERISTICS

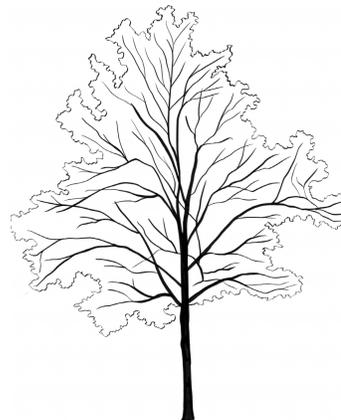
HEIGHT	25-40'	FLOWER	Female is inconspicuous but visible in spring, male has worm-like, yellow-brown catkins visible in winter
WIDTH	20-40'	FRUIT	Small, green turning to tan, hop-like pods in hanging clusters
GROWTH	Slow	FOLIAGE	Dark green turns to yellow-brown to red in fall, drop early
FORM	Oval to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

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

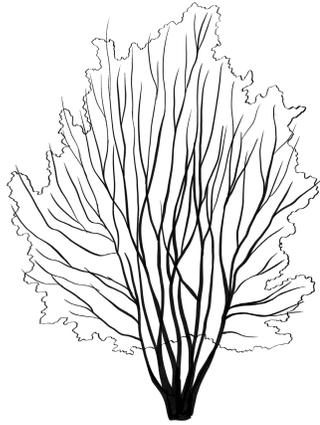
Named the Society of Municipal Arborists' 2019 Urban Tree of the Year, this adaptable species may have limited availability.





PERSIAN PARROTIA

Parrotia persica



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Japanese beetle	CULTIVARS	'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
TOLERATES	Drought, heat		
TRANSPLANT	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

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

CHARACTERISTICS

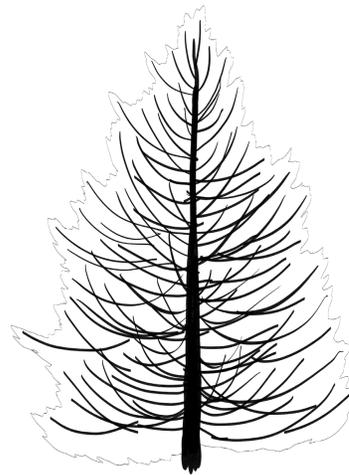
HEIGHT	50-60'	FLOWER	Inconspicuous
WIDTH	20-25'	FRUIT	Pendulous cones, purple turn to cinnamon-brown at maturity
GROWTH	Slow - medium	FOLIAGE	Glossy, dark green needles year round
FORM	Narrowly pyramidal, gracefully arching branching	BARK	Dark black-brown with thin, peeling scales

PLANTING CONSIDERATIONS

PESTS	Borers and aphids are occasionally an issue	CULTIVARS	'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
TOLERATES	Pollution		
TRANSPLANT	B&B recommended		

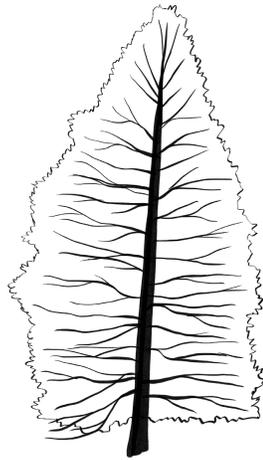
NOTES & LIMITATIONS

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	'Nana' has a pyramidal habit, grows to be 20' tall; 'Columnaris' has a dense, narrow fastigate form
TOLERATES	-		
TRANSPLANT	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

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

CHARACTERISTICS

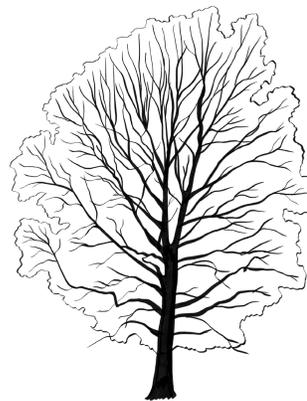
HEIGHT	70-100'	FLOWER	Not ornamentally important
WIDTH	65-80'	FRUIT	Pairs hang on long stalks, turns from green to brown, persists through winter
GROWTH	Medium	FOLIAGE	Medium to dark green turns to yellow-brown in fall
FORM	Pyramidal in youth, open, spreading, rounded at maturity	BARK	Ornamental, exfoliates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

PLANTING CONSIDERATIONS

PESTS	A tough tree, but overuse has encouraged issues: plum borer, sycamore lacebug, canker stain, anthracnose, powdery mildew	CULTIVARS	'Columbia' and 'Liberty' resistant to anthracnose & powdery mildew; 'Bloodgood' resistant to anthracnose; 'Exclamation™' 'Morton Circle' resistant to anthracnose, powdery mildew, and frost cracking
TOLERATES	Drought, flooding, pollution, poor drainage		
TRANSPLANT	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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

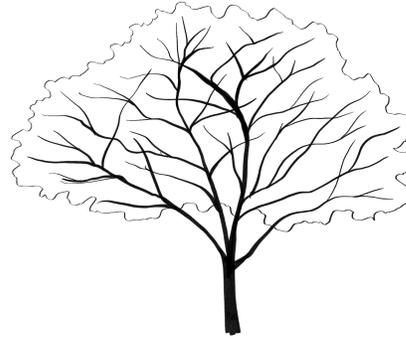
PESTS	Reportedly more resistant to the many pests that species is susceptible to	CULTIVARS	Information is cultivar-specific
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TOLERATES Salt

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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

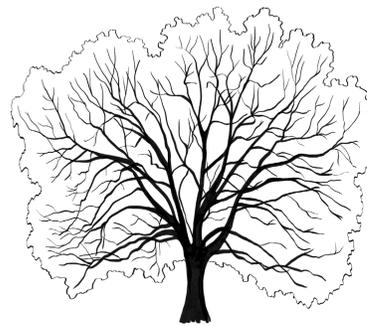
PESTS	Susceptible to gypsy moth, two-lined chestnut borer, scale, galls, cankers; shows oak wilt resistance	CULTIVARS	<i>Q. alba</i> x <i>Q. robur</i> : Crimson Spire™ 'Crimschmidt' has a narrow form, tolerates a wide range of conditions, has good red fall color; Streetspire® 'JFS-KW1QX' has a narrow,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

TRANSPLANT Difficult

NOTES & LIMITATIONS

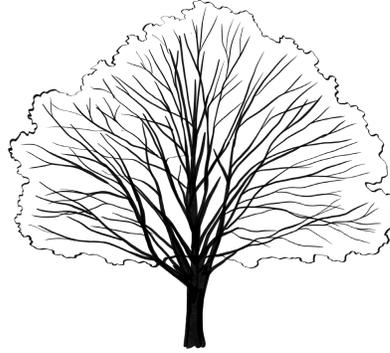
This large native species is highly valued in the landscape for its majestic appearance and adaptability. However, it is notably difficult to transplant, and it is recommended to do so when the tree is young.





SWAMP WHITE OAK

Quercus bicolor



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Susceptible to gypsymoth, orange-striped oakworm, anthracnose, canker, powdery mildew	CULTIVARS	Regal Prince® 'Long' and Rosehill® 'Asjes' have narrow oval habit, grow to be 20' wide, and are highly mildew resistant
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TOLERATES Drought, flooding, salt, pollution, poor drainage

TRANSPLANT 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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

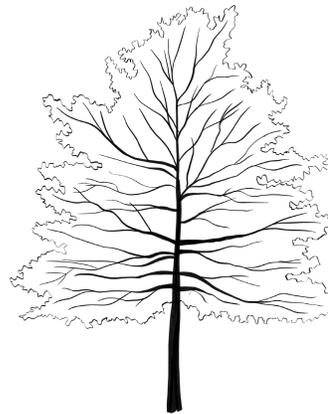
PESTS	Susceptible to gypsymoth, two-lined chestnut borer,	CULTIVARS	-
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TOLERATES Drought

TRANSPLANT 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

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

CHARACTERISTICS

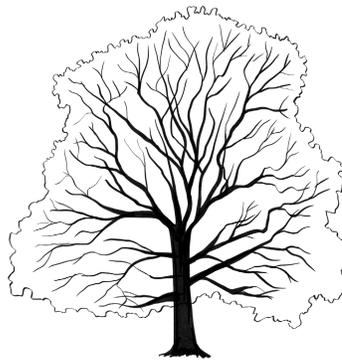
HEIGHT	40-60'	FLOWER	Not ornamentally important
WIDTH	40-65'	FRUIT	Acorns
GROWTH	Slow	FOLIAGE	Emerging reddish, glossy dark green turns to yellow-brown or russet-red in fall, persists through winter
FORM	Pyramidal in youth, oval-rounded at maturity, upright, spreading branches, lower branches descending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

PLANTING CONSIDERATIONS

PESTS	Susceptible to gypsy moth, anthracnose, canker, rust, powdery mildew, wilt, galls	CULTIVARS	-
TOLERATES	Flooding, salt, shearing		
TRANSPLANT	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

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

CHARACTERISTICS

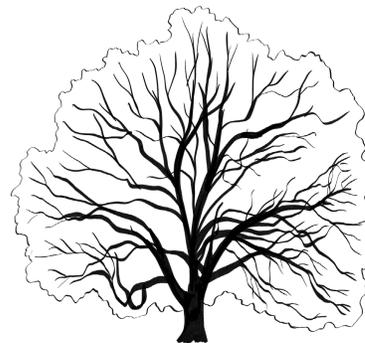
HEIGHT	60-80'	FLOWER	Not ornamentally important
WIDTH	60-90'	FRUIT	Acorns, heavy crop every 3-5 years
GROWTH	Slow	FOLIAGE	Dark green turns to yellow-green or yellow-brown in fall
FORM	Pyramidal to oval in youth, rounded and open with age	BARK	Gray-brown, develops deep ridges and furrows

PLANTING CONSIDERATIONS

PESTS	Susceptible to gypsy moth, two-lined chestnut borer, anthracnose, webworm, leaf miner	CULTIVARS	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
TOLERATES	Drought, flooding, poor drainage		
TRANSPLANT	Difficult, young trees B&B or CG recommended		

NOTES & LIMITATIONS

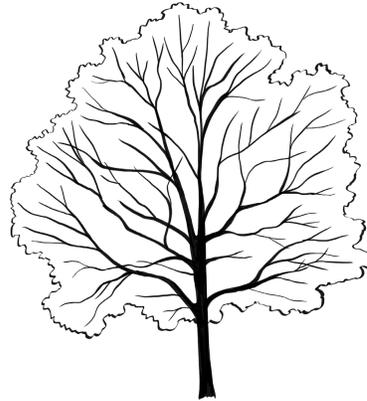
More adaptable to adverse conditions than most other oaks, this species was named the Society of Municipal Arborists' 2001 Urban Tree of the Year. Acorns can be a litter issue.





CHESTNUT OAK

Quercus montana



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Susceptible to scale, two-lined chestnut borer, mites	CULTIVARS	-
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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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

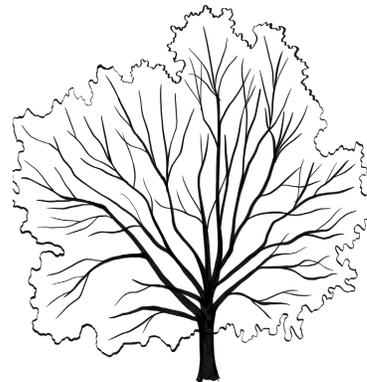
PESTS	Susceptible to gypsy moth, leaf miners, orange-striped oak worm, acorn weevils	CULTIVARS	-
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TOLERATES Drought, salt

TRANSPLANT Difficult, B&B recommended

NOTES & LIMITATIONS

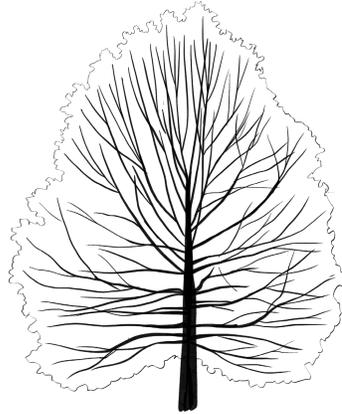
More adaptable to adverse conditions than most other oaks, this species was named the Society of Municipal Arborists' 2009 Urban Tree of the Year. Acorns can be a litter issue.





PIN OAK

Quercus palustris



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Overuse has encouraged issues: gypsy moth, wilt, galls, cankers; resistant to anthracnose	CULTIVARS	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

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

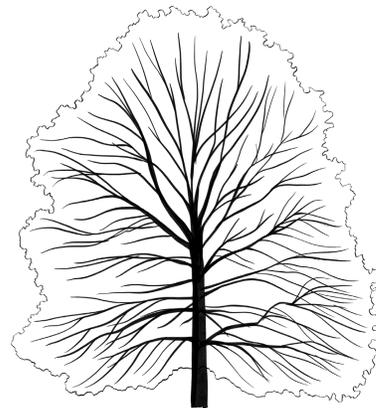
PESTS	Susceptible to gypsy moth, borers, scale, orange-striped oakworm; resistant to anthracnose	CULTIVARS	'Hightower' has a uniform, dense form, 55' x 30', mite resistant; 'Upperton' grows to be 60' x 30'
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TOLERATES Drought, flooding, heat, salt, poor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

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

CHARACTERISTICS

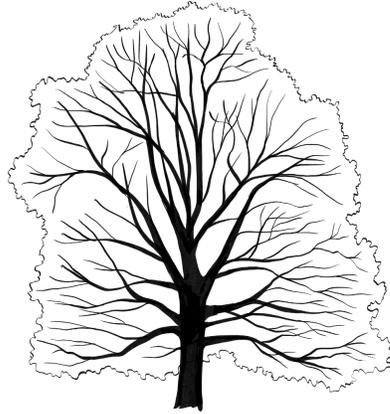
HEIGHT	40-60'	FLOWER	Not ornamentally important
WIDTH	40-60'	FRUIT	Acorns
GROWTH	Slow - medium	FOLIAGE	Dark green to blue-green, either drop green or turn to brown in fall
FORM	Pyramidal or oval in youth, broadly open and rounded at maturity	BARK	Grayish-black, deep furrows and ridges

PLANTING CONSIDERATIONS

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

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

CHARACTERISTICS

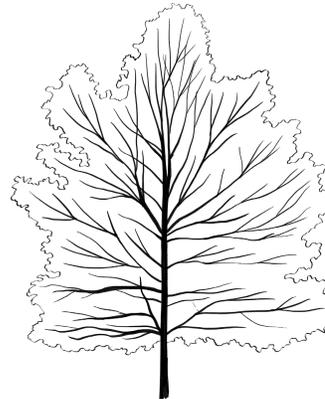
HEIGHT	40-60'	FLOWER	Not ornamentally important
WIDTH	40-65'	FRUIT	Acorns
GROWTH	Slow - medium	FOLIAGE	Dark green turns to yellow-bronze or red in fall
FORM	Pyramidal in youth, broadly oval to rounded at maturity	BARK	Gray-brown, developing somewhat platy ridges and furrows with age

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

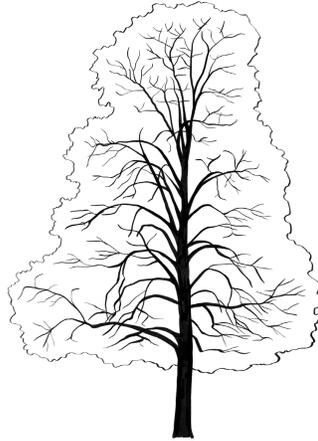
This species' extreme adaptability to adverse conditions and ease of transplanting make it a popular tree in the urban environment. Acorns can be a litter issue.





COMMON SASSAFRAS

Sassafras albidum



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Susceptible to borers and bagworms	CULTIVARS	'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

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

CHARACTERISTICS

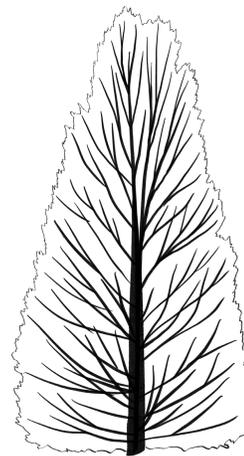
HEIGHT	20-30'	FLOWER	Not ornamentally important
WIDTH	15-20'	FRUIT	Upright, oval cones turn from green to brown at maturity
GROWTH	Very slow	FOLIAGE	Large, glossy dark green needles are not true leaves; true leaves hug branches and are small, scale-like and inconspicuous
FORM	Compact in youth, typically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

PLANTING CONSIDERATIONS

PESTS	Generally pest-free	CULTIVARS	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
TOLERATES	-		
TRANSPLANT	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

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

CHARACTERISTICS

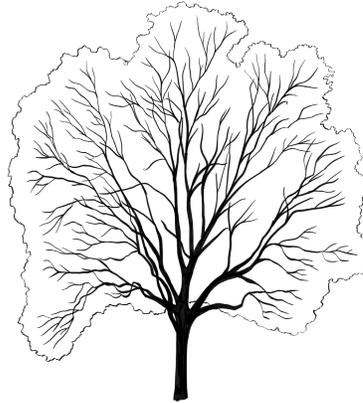
HEIGHT	50-70'	FLOWER	Showy, slightly fragrant, creamy white pea-like flowers in clusters, appear mid-summer
WIDTH	35-55'	FRUIT	Bright green pods turn to yellow-brown
GROWTH	Medium - fast	FOLIAGE	Lustrous, bright green in summer turns yellowish in late fall
FORM	Oval to rounded with upright spreading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

PLANTING CONSIDERATIONS

PESTS	Stem canker possible in harsh winters	CULTIVARS	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
TOLERATES	Drought, salt, pollution		
TRANSPLANT	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

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

CHARACTERISTICS

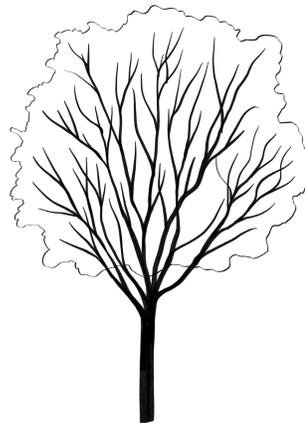
HEIGHT	20-30'	FLOWER	Showy, fragrant, cream colored pyramidal clusters; flowers best in full sun
WIDTH	15-25'	FRUIT	Tan capsules
GROWTH	Slow	FOLIAGE	Dark green, often nonexistent fall color, occasionally dull yellow
FORM	Oval	BARK	Ornamental, smooth reddish-brown, with horizontal lenticels

PLANTING CONSIDERATIONS

PESTS	None serious; resistant to powdery mildew and scale	CULTIVARS	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
TOLERATES	Drought, salt, pollution		
TRANSPLANT	Easy B&B or ≤2" caliper BR		

NOTES & LIMITATIONS

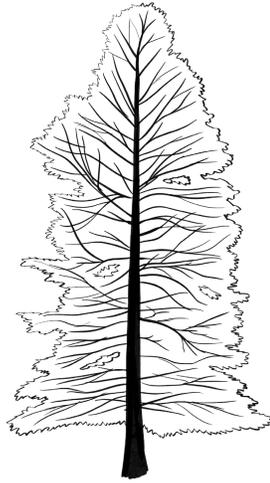
Reportedly the most adaptable lilac, this species makes a beautiful street tree. However, it has begun to cause concern related to invasive potential - recommended to not plant near natural settings where they could invade, and to monitor.





BALDCYPRESS

Taxodium distichum



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Susceptible to spider mites, forest tent caterpillar moth	CULTIVARS	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
TOLERATES	Drought, flooding, salt, pollution, poor drainage, wind damage		
TRANSPLANT	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

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

CHARACTERISTICS

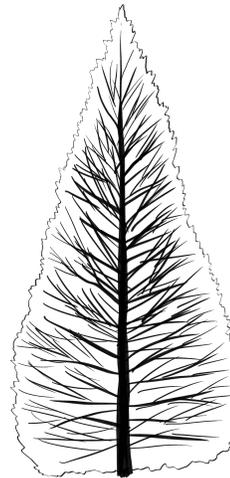
HEIGHT	40-60'	FLOWER	Not ornamentally important
WIDTH	10-15'	FRUIT	Small, brown to tan cones
GROWTH	Slow	FOLIAGE	Dense, rich green needles may turn to yellowish-green in winter
FORM	Narrow- to broadly-pyramidal	BARK	Gray to reddish-brown furrows

PLANTING CONSIDERATIONS

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

NOTES & LIMITATIONS

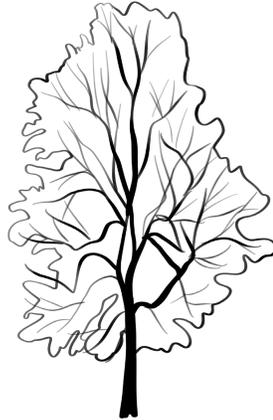
Also known as White Cedar, this popular evergreen is both attractive and adaptable, although it may be susceptible to deer browse and branch breakage. Although climate change projections show a potential for a partial loss of habitat suitability for this species in Massachusetts, it may be able to adapt.





AMERICAN LINDEN

Tilia americana



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	None serious, but susceptible to linden mites, Japanese beetles, aphids	CULTIVARS	'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
TOLERATES	Flooding, poor drainage		
TRANSPLANT	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

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

CHARACTERISTICS

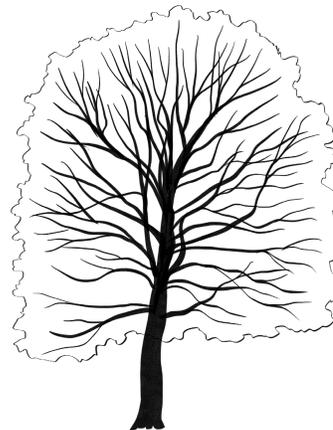
HEIGHT	50-70'	FLOWER	Yellowish flowers in loose drooping clusters attached to leaf-like bracts, fragrant
WIDTH	30-50'	FRUIT	Small, globose nutlets
GROWTH	Medium - fast	FOLIAGE	Dark green turns to yellow-green to yellow in fall
FORM	Pyramidal in youth, upright-oval to pyramidal-rounded at maturity, dense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

PLANTING CONSIDERATIONS

PESTS	Aphids, Japanese beetles, and sooty mold can be serious issues	CULTIVARS	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
TOLERATES	Pollution, shearing		
TRANSPLANT	Easy B&B or ≤2" caliper BR		

NOTES & LIMITATIONS

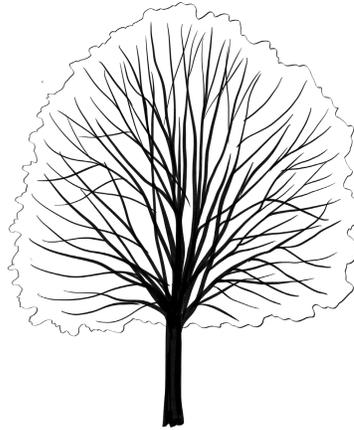
This species is much more commonly planted than *T. americana*, due to its adaptability to adverse conditions, although it may be susceptible to branch breakage.





SILVER LINDEN

Tilia tomentosa



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	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>	TOLERATES	Drought, heat, pollution, shearing
TRANSPLANT	Moderately difficult B&B or BR, slow to establish		

NOTES: Japanese beetle and Gypsy Moth; Green Mountain® 'PNI 6051' is faster growing; Satin Shadow™ 'Sashazam' may be more cold hardy, reportedly resistant to Japanese beetle, uniform symmetrical growth make it better suited for street use

NOTES & LIMITATIONS

Noted as the most beautiful linden, this species is quite adaptable to adverse conditions, although it may have limited availability.

AMERICAN ELM CULTIVARS

Ulmus americana



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

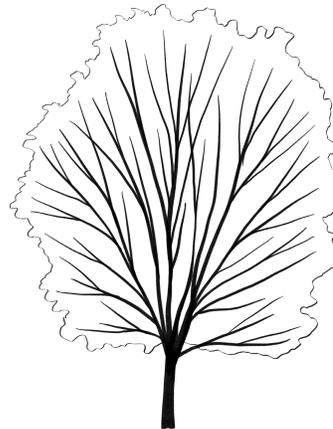
HEIGHT	60-80'	FLOWER	Not ornamentally important
WIDTH	30-60'	FRUIT	Small, greenish-yellow samaras
GROWTH	Medium - fast	FOLIAGE	Green to dark green turns to yellow in fall
FORM	Varies, often majestic and vase-shaped	BARK	Dark gray with broad, deep ridges

PLANTING CONSIDERATIONS

PESTS	Cultivars resistant to Dutch elm disease, elm yellows and elm leaf beetle resistance varies; susceptible to Asian longhorned beetle, cankers, aphids, powdery mildew	CULTIVARS	'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
TOLERATES	Drought, flooding, salt, pollution, poor drainage		
TRANSPLANT	Easy B&B or ≤2" caliper BR		

NOTES & LIMITATIONS

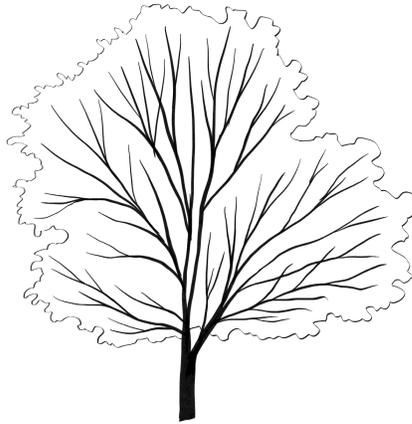
The beauty and adaptability of this native species is perhaps unmatched, however, extreme caution should be used when selecting due to the severity of pest issues and susceptibility to branch breakage caused by poor structure. New cultivars show promising pest resistance, and are strongly recommended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





LACEBARK ELM

Ulmus parvifolia



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Shows resistance to elm leaf beetle, Japanese beetle, Dutch elm disease, and elm yellows	CULTIVARS	'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
TOLERATES	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

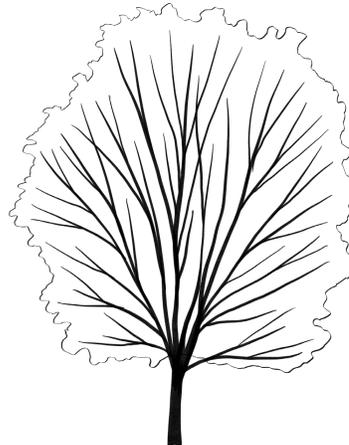
ZONE	Varies, 3B-5A	SOIL PH	≤8.2
LIGHT	Full sun	MOISTURE	Tolerates prolonged periods of dry soil and occasional periods of saturated soil

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Listed cultivars are resistant to Dutch elm disease, resistance to elm yellows and elm leaf beetle varies	CULTIVARS	'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
TOLERATES	Drought, flooding, salt, pollution, poor drainage		
TRANSPLANT	Easy B&B or ≤2" caliper BR		



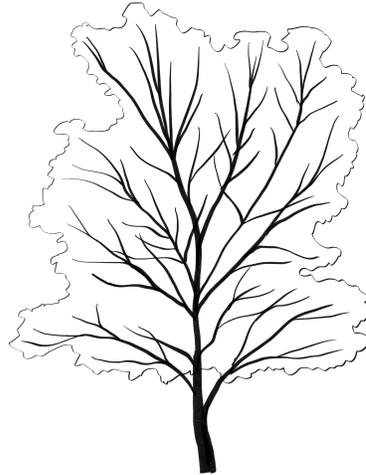
NOTES & LIMITATIONS

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



SIELBOLD VIBURNUM

Viburnum sieboldii



ENVIRONMENTAL CONDITIONS

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

CHARACTERISTICS

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

PLANTING CONSIDERATIONS

PESTS	Not susceptible to Viburnum leaf beetle	CULTIVARS	'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
TOLERATES	Shearing		
TRANSPLANT	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

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

CHARACTERISTICS

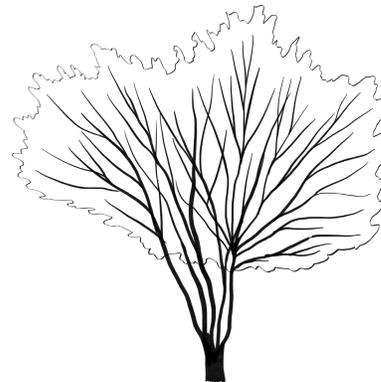
HEIGHT	50-80'	FLOWER	Not ornamentally important
WIDTH	40-60'	FRUIT	Not ornamentally important
GROWTH	Medium	FOLIAGE	Dark green turns to variable yellow, orange, red, bronze, purple mix in fall
FORM	Vase-shaped with upright arching branches and a short trunk	BARK	Ornamental, brown and smooth in youth,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

PLANTING CONSIDERATIONS

PESTS	Japanese beetles feed on foliage, shows resistance to Dutch elm disease and bacterial canker	CULTIVARS	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
TOLERATES	Drought, heat, salt, pollution		
TRANSPLANT	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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