

Recommended Species for the City – Connecting the Dots

Recommended Species Chapter written by David Jahn, Des Moines City Forester, 2011-2020

Contributor: Elise Jeanette Hario, Volunteer Forestry Assistant, Des Moines Forestry Division, 2012-2020

Introduction



Figure 1. A diverse collection of shade and ornamental trees on the State Capitol grounds provide respite and a welcome for visitors to Iowa's magnificent State government edifice

Selection of tree species is an essential task at any time. Proper tree selection has taken on new urgency considering current changes in our climate. The traditional method has been to ensure that the tree selected for a site will conform to the U.S. Department of Agriculture (USDA) Plant Hardiness Zone Map. The purpose of the USDA Hardiness Zone Map is to indicate annual low temperatures to determine when a planting zone is too cold for the plant to survive. In addition, local conditions such as normal or extreme rain or drought patterns, shade and salt tolerance, and tree location in relation to overhead wires should

all be considered. These considerations constituted the previous siting standard to plant trees for decades, but times have changed. Des Moines and the rest of the country are regularly bombarded by weather events of increasing occurrence and greater magnitude. This upsurge in extreme climatic events prompts extra consideration in the selection of trees. Also, standards have changed in the building industry and have been allowed by State Code, whereby topsoil stripped from construction sites is no longer sufficiently replaced for lawns, gardens and trees. This negative site attribute results in greater difficulty establishing trees and other plants, and often results in mediocre or poor results after the hard work of planting and maintenance. The intent of this species chapter is to outline the City of Des Moines protocol for proper tree selection, and to introduce the current **Recommended Species List** for use by city departments, developers and landscapers, and all city residents.

Utilities



Smaller trees under utility wires

Planting medium-sized or large trees underneath overhead utility lines is a costly mistake. The electric utility bears sole responsibility to provide 'safe, effective electric service' to residents. When meeting safety standards on tall trees prompts removal of too much tree canopy, the result is poor shape and pruning cuts that can lead to disease. Shade on both sides of the street is desirable so the City chooses to employ the **Right Tree, Right Place** standard that is used nationally. Right Tree, Right Place mandates that only shorter trees be planted under overhead wires. This means that ornamental trees like serviceberry, redbud and other trees that mature under 25' tall are planted in these locations. This is a winning situation for the

utility and the public. If any pruning is required under wires it has less effect on smaller trees, and the resident still has the beauty and many of the environmental, social and economic benefits of a larger tree. The city makes a point of planting larger shade trees in every possible location, just not under overhead wires.

Infrastructure Conflicts

Green and gray infrastructure conflicts are common. They include traffic sight obstruction, competition with overhead wires, proximity to signs, lights, water connections and fire hydrants, and competition for space with curbs, sidewalks and other forms of infrastructure.

Des Moines commits to a multi-faceted response to all competing demands so that when employing wise tree selection, the tree will have the best chance at surviving and thriving.



Figure 2. Tree and hydrant compatibility require proper distancing

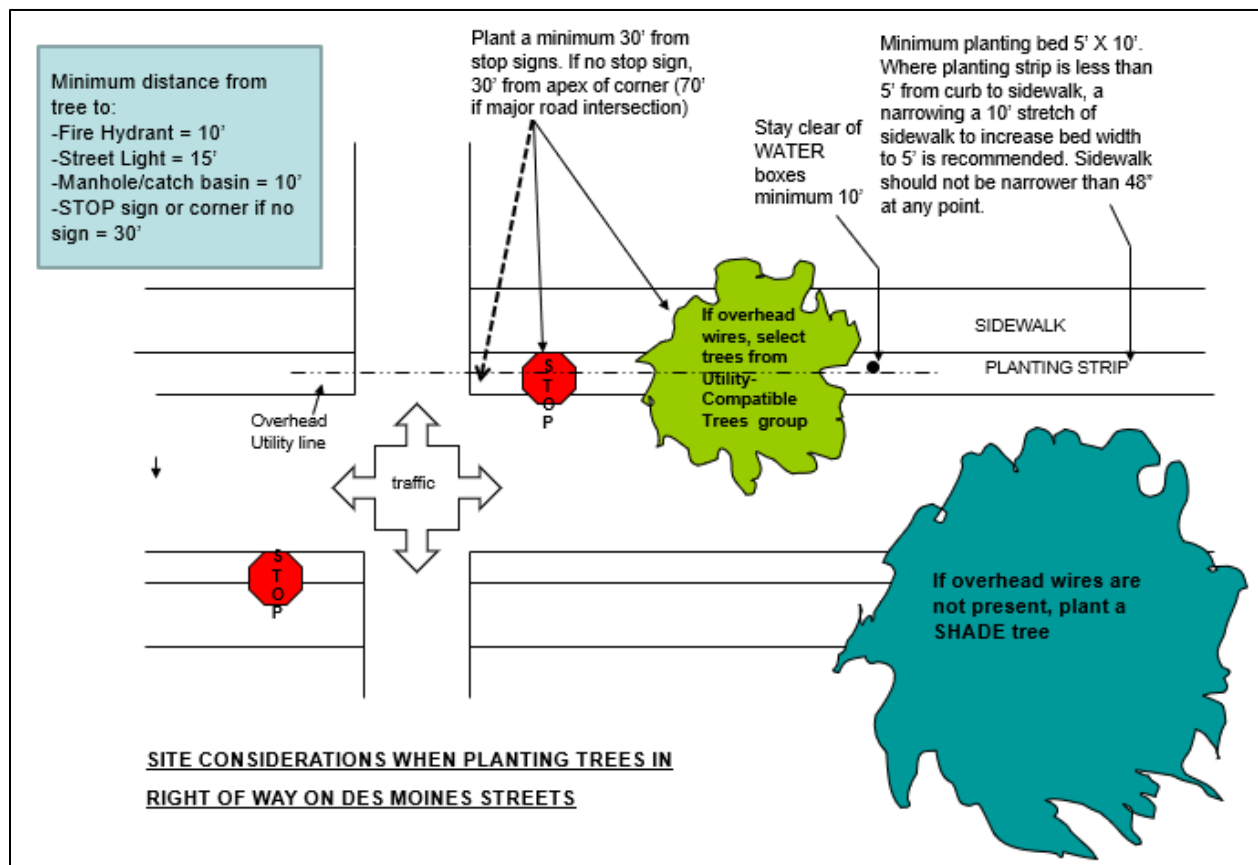


Figure 3. Site Analysis graphic for field use by tree inspectors. Choosing the right tree for each planting location is critical to prolonging the tree's life and making Des Moines a greener, healthier city

Trees typically require the following distances from various forms of infrastructure:

- Overhead wires – plant only shorter ornamental trees (25' max height)
- Water connections – 10'
- Manhole or catch basin – 10'
- Fire Hydrants – 10'
- Street Lights – 15'
- Stop Signs – 30'
- Alleys – 10-20' depending on traffic volume and visibility
- Driveways – 10'
- Intersecting Streets – 30' (or 30' to the stop sign, whichever is greater). If the approaching street is a busy arterial, a 70' sight triangle is provided

Main Planting Areas

Trees in Des Moines are planted in three different and uniquely important areas. This includes street trees, park trees and private property trees. The City takes responsibility for planting, maintaining and removing street and park trees. Residents are encouraged to be good environmental stewards and plant trees on their private property for the betterment of the community.



Street Trees – A street tree is defined as a tree growing on the public right-of-way (ROW), usually between the curb and the sidewalk. Annually hundreds of trees are planted proactively by the City and its agents, but property owners may also request that a street tree be planted on the ROW adjacent to their property. Such requests may be made by calling the 24-hour Public Works Call Center at (515) 283-4950. If residents wish to plant on the ROW at their own expense, a no-cost permit will be granted by the City after discussion of siting and proper species selection.

Park Trees – A ‘park’ tree may be defined differently depending on the park and its management objectives. There are many individual park trees sited throughout city parks on the mowed areas and around structures, playgrounds and athletic facilities. There are also trees in forests, since many parks were originally created from open space created from forest land. In the City of Des Moines the Parks and Recreation Department manages all park lands. The Public Works Forestry Division manages tree maintenance and removal within the parks.



Private Trees – The majority of the urban tree canopy is located on private land throughout the city. Private property also presents the greatest opportunity for new tree planting to help the City reach its tree canopy expansion goals. Land uses include single-family residential, multi-family residential, commercial/industrial, agricultural, vacant, institutional, utility, transportation, wetlands, and other mixed or independent uses. Various land uses will have trees planted with specific performance goals in mind. A riparian corridor may have trees planted to prevent erosion and improve stream flow. Hospitals and medical centers may plant trees to improve human health. Industrial tracts may plant trees to mitigate their carbon footprint and improve air quality. High density developments with a large amount of

impervious land cover may find innovative ways to site trees in an effort to offset the urban heat island effect.

A critical step before planting trees in all three of these areas (street, park and private) is completion of a comprehensive site analysis that considers climate, site micro-climate (hardiness zone, light conditions, heat and wind), soil factors (soil pH, texture, compaction levels, drainage characteristics, yearly salt application), above-ground limitations (overhead wires and proximity to structures), and below-ground limitations (rooting space and infrastructure conflicts). The cost of skipping a comprehensive site analysis can be counted by dead or poor performing trees and unrealized benefits to the community.

Tree Characteristics

A comprehensive site analysis is then followed by applying an understanding of a host of tree characteristics. The goal is to select a tree that will flourish on a particular site. The Recommended Species List has selected trees that will thrive in a wide range of conditions, so that upon completion of site analysis one or several tree species may be selected that are appropriate to the site. The list starts with diversity.

Diversity – Des Moines has recorded over 100 different species of trees growing on public property. The public is welcome to visit desmoinesia.treekeepersoftware.com to see details of the public tree inventory. Currently the City recommends planting 38 different species of shade tree (8 are different species of oak), 10 species of ornamental trees and 7 species of conifers. Previous planting methodology allowed that a single species could fill an entire street, section of park, or development site. Current methodology dictates that multiple species be planted so as to reduce the negative impact if an insect or disease is introduced to trees in the city. At the writing of this Urban Forest Master Plan (UFMP) Des Moines has been proactively removing ash trees due to the unfolding impact of the emerald ash borer insect. In locations where entire streets or entire blocks of street trees were comprised only of ash trees, the loss has been immediate and drastic. Planting multiple diverse species on streets, in park settings and even on private properties makes sense in the long run, so that any potential future tree losses are restricted to one species at a time. As a general rule of thumb, the City recommends no more than 30% of one ‘family’ of trees, no more than 20% of one ‘genus’ of trees, and no more than 10% of any one ‘species’ of trees. Ambitious planners and designers may aspire to meet a more rigorous guideline of no more than 15% of one family, 10% of one genus or 5% of one species.



Figure 4. shows tunneling under bark of the ‘first discovered’ EAB-infested ash in Des Moines on 67th St near Urbandale Ave. (January 2016)



Figure 5. Tivon Feeley (on left) from Iowa DNR helped identify EAB in Des Moines

Invasiveness – Non-native tree species like tree-of-heaven (*Ailanthus altissima*) colonize vacant lots and hillsides, displace native trees, and fragment forests. Tree-of-heaven (TOH), pictured at right, was introduced into the U.S. by a gardener in Philadelphia in 1784. This Asian tree was initially promoted as a host tree for silk moth production. The tree rapidly spread because of an ability to grow quickly under adverse conditions. It also produces a poisonous chemical called ‘ailanthene’ in TOH bark and leaves that kills nearby vegetation and helps limit its competition. Two other trees designated by the Iowa DNR as invasive are Siberian elm (*Ulmus pumila*) and white mulberry (*Morus alba*). Also of concern nationally is Black locust (*Robinia pseudoacacia*). This North American native tree has been planted extensively for its nitrogen-fixing abilities, as a source of nectar for honeybees, and for fence posts and hardwood lumber. Its commercial value and soil-building properties encourage further transportation outside its natural range. Black locust is native to the Southern Appalachians and the Southeastern U.S. The tree has been planted in many temperate climates and is naturalized throughout the U.S., within and outside of its historical range, and in some parts of Europe. The tree has spread to and become invasive in other parts of the country. Once introduced to an area, black locust expands readily into areas where their shade reduces competition from other sun-loving plants. The tree poses a serious threat to native vegetation (especially in the Midwest) in dry and sand prairies, oak savannas, and upland forest edges outside of its historic North American range. Flowering pear (*Pyrus calleryana*) trees are invasive as well. All of the aforementioned trees are excluded from the Recommended Species List.



Paul Wray, IA State Univ.

Hardiness – Previous mention of ‘hardiness’ referenced the USDA Hardiness Zone Map, used to identify average ‘low’ temperatures in regions of the country. Des Moines resides in Zone 5 (annual minimum temperature of -10 to -20 degrees Fahrenheit). In the context of the present UFMP discussion, hardiness includes all of the various climatic (hot or cold) and micro-climatic influences placed upon the tree. Increasing temperatures due to the urban heat island effect require that heat sensitive trees are not placed in the wrong location. A tree that wilts or scorches in summer heat, like sugar maple or horsechestnut, should not be planted downtown as a street tree due to the heat gain from buildings and pavement, and the possibility of reflected heat from glass surfaces. The same tree is safer as a street tree in a residential setting, where it is adjacent to lawn on one side and where an expansive grass strip on the ROW can provide much-needed moisture.

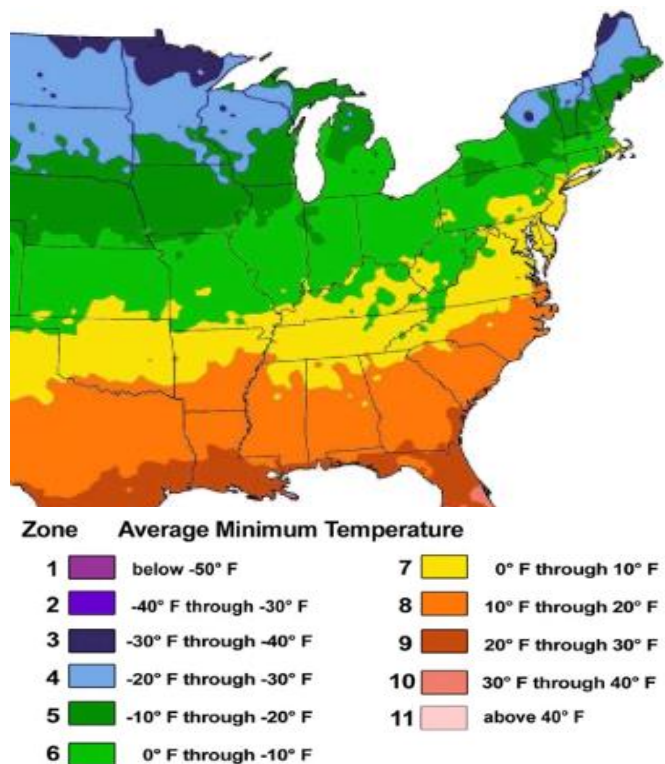


Figure 6. Des Moines is in Hardiness Zone 5

Disease and Pest Resistance – The current presence and future possibility of lethal insects and diseases mandate diligence in selection and placement of trees. The current situation where emerald ash borer



Figure 7. Red oak leaves in various stages of oak wilt

(EAB) is expected to kill virtually all native ash trees mandates that we should never plant ash (*Fraxinus spp*) again. Oak wilt disease affects oak, but most significantly on red oak. Therefore, highly desirable red oak should be planted in isolation and in smaller quantities on any single site. Bur oak blight disease makes it prudent that bur oak (state tree of Iowa) should be planted in limited quantities and well-spaced throughout the city and on development projects. Maple is not currently on the Recommended Species list for two

reasons: First, maple already represents fully 17% of tree species in the city. Second, Asian Longhorned Beetle is a potential threat to several species of our trees. This foreign invader has damaged urban trees in Boston, New York, Toronto and Columbus. Its preferred target is maple, so the City does not recommend planting maple at this time! The Insects, Diseases and Invasives chapter of this UFMP discusses pests at length. Suffice to say that all of these are important to consider when trees need to be selected for planting.

Mature Size and Form – The urban environment often has limited growing space. Trees need room for the canopy to expand and grow, but the roots also require opportunity to push through soil without risking infrastructure or outgrowing their space. Most park sites have ample room for tree growth above and below ground, but that is often not the case for street trees. Potential street tree planting sites are defined as areas suitable for tree planting within the existing right-of-way. The size of the site should be designated as small (for ornamental trees) or large (for shade trees) depending primarily on the growing space available and the presence of overhead wires. The overall landscape and existing planting scheme should also be taken into consideration in the spacing and dimensions of chosen planting sites. Ensuring that a tree reaches its full growth potential will depend on the amount of available soil volume and surrounding site constraints. Minimum soil volumes for root space are suggested to be 1–2 cubic feet for each square foot of projected mature crown (Lindsey and Bassuk 1991). Other formulas have derived minimum soil volumes based on trunk to crown diameter (Urban 2008). Urban foresters generally adhere to the following soil volume minimums: 300 cubic feet for small trees, 600 cubic feet for medium trees, and 1,000 cubic feet for large trees. Planting site width is critical to calculating available soil volume; a site's capacity influences the size of trees selected. Small trees require minimum widths of



Figure 8. The stump at lower left of this grave stone at Glendale Cemetery is the remains of a cedar tree that was in the way and had to be removed to prepare a burial site.

4–6 feet between curb and sidewalk, medium trees 6–8 feet, and large trees 8 feet or greater. These are ‘ideal’ measurements. Spacing depends on the size of adjacent tree canopy diameters and should be no less than half of the projected crown size at maturity. Each prospective planting site will vary in its tree-carrying capacity. City trees invariably are planted into smaller than desired spaces in order to maximize planting opportunities.



Aesthetics – While the functional structure (shape) and bark, flowers, foliage and fruit (beauty) associated with specific trees is not at the top of the list of selection attributes they are nonetheless important. Flowering trees are popular, but they are primarily ornamental in size and the City takes every advantage possible to plant larger shade trees to maximize benefits. Flowering pear is beautiful tree during bloom, but as an invasive species it is not to be considered a candidate for planting in the city.

Figure 9. A spectacular aesthetic is created with this double row of sycamore trees on Sheridan Ave



Figure 10. This 39” diameter bur oak in Waveland Golf Course had decay inside the trunk. It fell apart in a wind storm

Longevity – Trees are sometimes short-lived in Des Moines due to poor species selection, lack of care (especially during the 2-year establishment period) and challenging growing conditions. All trees should be planted with a minimum 25-year lifespan in mind. Long-lived ornamental trees can live to 35 years and more, while shade trees in the city may live 60-90 years or longer depending on species. The longer the life of the tree the more benefits accrue for the good of residents.



Figure 11. To measure lifespan of the tree, push pins (25) were placed at every 5th annual growth ring on the stump. The tree was 125 years old and was providing maximum environmental benefits

Native or Non-native – It could very well be that the majority of trees in the city are not native, but instead are hybrids or cultivars that could be several versions separated from the original native tree of that species. There is a renewed call for native trees because they naturally have defense mechanisms against insects and disease whereas some of the hybrids or cultivars have less genetic diversity. Supply then becomes a consideration because the tree nursery industry is by and large equipped to grow and ship hybrids and cultivars. Whether native or otherwise, if a tree is correctly selected for the planting site, gets well established and remains unscathed by storm, insect and disease, the outcome is still positive.

Litter – Fruit can become a nuisance for adjacent property owners. Only male trees of the ginkgo (*Ginkgo spp*) species may be planted because the fruit of the female tree upon ripening turns into a smelly mess that absolutely no resident wants to deal with. The City is reluctant to remove any existing female ginkgo trees in spite of protestations, because ginkgo represents one of the longest-lived trees on the planet. There are no known insect or disease issues on this species which makes them an anomaly among the other trees in the city. Persimmon (*Diospyros virginiana*) may be better used in a park setting than on the street due to the presence of fallen fruit. Likewise, sweetgum (*Liquidambar styraciflua*) is not the best choice planted over a sidewalk due to the spiky gumballs that fall and create a walking difficulty for pedestrians. Oak (*Quercus spp*) tree acorns on the other hand are smaller and don't represent the same level of risk to walkers.

Selecting Trees for the Future

Trees will be affected by a changing climate over the next century. Reference has been made in the Climate Change chapter of the UFMP to an increase in temperature, longer growing seasons between late and early frost, and increase and severity of weather events. Since the trees planted today will be either enjoyed or missed by the tree planter's grandchildren, species adaptation to climate impact should be considered. Over the last 5-8 years Iowa has seen major winter impacts to white cedar (*Thuja occidentalis*). Previously it was thought that severe browning of foliage was a result of desiccation, whereby winter winds were drawing moisture out of the tree. Tree experts now think that climate change is the problem. We are getting an increase of warm weather periods in Iowa winters when it should be cold and plants are supposed to be dormant. An increase in winter temperature prompts the tree to come out of dormancy, and damage is incurred when the waking foliage is re-introduced to freezing temperatures within hours or days. Consideration of this winter thawing phenomenon, plus the increasing possibility of extended summer heat, has prompted the Chicago Botanical Garden to issue a climate change projection whereby the region is no longer able to grow previously reliable conifers. This has profound implications for landscape planners in Des Moines. Conifers are used in development to create visual buffers between land uses. An example would be using conifers in a visual buffer between a gas station and residential neighbors, or between heavy industrial and commercial property. Conifers are also used to provide winter interest when deciduous trees are dormant and leaves have fallen. Their potential loss to the landscape will be measurable and dramatic. For more information about climate change vs. tree species selection, the reader may access research from the Central Hardwoods Climate Change Response Framework at <https://www.nrs.fs.fed.us/pubs/45430>



<https://statesatrisk.org/iowa/extreme-heat>

Winners and Losers in Tomorrow's Urban Tree Canopy

The Northern Institute of Applied Climate Science (NIACS) has created climate change projections for individual tree species. Some of the data from the Illinois projection was used to create the winners and losers chart below. The NIACS modeling accounted for both a 'low' climate change scenario and a 'high' climate change scenario. The winners and losers chart below records only those trees that thrive or decline in both scenarios. Winners are so identified because these tree species are expected to increase 20% or more by the year 2100, whereas losers will decrease by 20% or more.

WINNERS: These species will <u>increase 20% or more by the year 2100</u>	LOSERS: These species will <u>decrease 20% or more by the year 2100</u>
American hornbeam	Black cherry (supports pollinators)
Black hickory	Butternut (food source for wildlife)
Blackjack oak	Eastern white pine (buffer and landscape tree)
Bur oak	Ohio buckeye (medicinal ingredients)
Eastern redbud	Shagbark hickory (habitat for Indiana bat)
Post oak	Shingle oak (supports pollinators)
Red mulberry	White oak (alternate for red oak due to oak wilt disease)
River birch	(supports pollinators)
Southern red oak	(supports pollinators)
Sugarberry	(supports pollinators)
Sweetgum	(supports pollinators)

Figure 12: This winners vs. losers chart shows which tree species may either thrive or not survive under extreme climatic change

The above chart is the Species chapter author's summary of local winners and losers. The reader may find a full list in the species projection document at <https://forestadaptation.org/learn/resource-finder/climate-change-projections-individual-tree-species-central-hardwoods-region>.

Recommended Species List for Des Moines

The Recommended Species List which follows is an adaptable tool, and species will be added and removed relative to local conditions. Species will change over time, not just because of climate but also due to local need and circumstance. Maple as a species is easy to grow and has been hybridized to provide amazing fall color variations. However, due to the fact of present maple overpopulation and heightened risk from an insect invader (Asian Longhorned Beetle), City of Des Moines has removed this species of tree from the Species List for the time being. Likewise, if a future day arrives when white pine responds poorly to climate change, it may be removed from the list. Currently it remains as an important buffer tree for landscape planners, and a beautiful option for the homeowner who wants conifers in the winter landscape both for beauty and for windbreak. It was pointed out earlier that more than 100 species of tree can be found in Des Moines. The Recommended Species List uses only 50+ of those species that are acceptable for use AND are commonly available from the tree growers. A practitioner or resident may be confident that tree choice and availability are relatively accurate at the time the list is offered. Since the List is adaptable, this print version identifies trees on the List at the time of publishing the UFMP, but an online version will always provide the most up-to-date information and changes. This may be accessed at [Recommended Species List for Des Moines](#).

SHADE TREES (street and park land)	
Common Name	Scientific Name
Birch, River	<i>Betula nigra</i>
Blackgum	<i>Nyssa sylvatica</i>
Cucumber Tree	<i>Magnolia acuminata</i>
Elm, Hybrid 'Patriot' 'Triumph' 'Valley Forge' 'Frontier'	<i>Ulmus spp.</i>
Ginkgo 'Autumn Gold' 'Lakeview' 'Princeton Sentry®' 'EmperorTM' Only male species	<i>Ginkgo biloba</i>
Hackberry 'Prairie Pride' 'Chicagoland' 'Windy City'	<i>Celtis occidentalis</i>
Hardy Rubber Tree	<i>Eucommia ulmoides</i>
Hickory, Mockernut	<i>Carya tomentosa</i>
Hickory, Shagbark	<i>Carya ovata</i>
Holly, American	<i>Ilex opaca</i>
Honeylocust, Thornless	<i>Gleditsia triacanthos var.</i>
Horsechestnut 'Baumanii'	<i>Aesculus hippocastanum</i>
Horsechestnut, Red 'Ruby Red' 'Briotii'	<i>Aesculus x carnea</i>
Ironwood, Persian	<i>Parrotia persica</i>
Japanese Pagoda Tree	<i>Styphnolobium japonicum</i>
Katsura Tree	<i>Cercidiphyllum japonicum</i>
Kentucky Coffee Tree (Only male species)	<i>Gymnocladus dioicus</i>
London Planetree 'Bloodgood' 'Yarwood'	<i>Platanus X acerifolia</i>
Linden, American 'Wandell' 'Redmond'	<i>Tilia americana</i>
Linden, Littleleaf 'Chancole' 'Corzam' 'Fairview' 'Glenleven'	<i>Tilia cordata</i>
Linden, Silver 'Green Mountain' 'Wandell'	<i>Tilia tomentosa</i>
Oak, Black	<i>Quercus velutina</i>
Oak, Bur	<i>Quercus macrocarpa</i>
Oak, Chinkapin	<i>Quercus muehlenbergii</i>
Oak, Red	<i>Quercus rubra</i>
Oak, Sawtooth White	<i>Quercus acutissima</i>
Oak, Swamp White	<i>Quercus bicolor</i>
Oak, Shingle	<i>Quercus imbricaria</i>
Oak, White	<i>Quercus alba</i>
Ohio Buckeye	<i>Aesculus glabra</i>
Persimmon	<i>Diospyros virginiana</i>
Sassafras	<i>Sassafras albidum</i>
Sycamore, American	<i>Platanus occidentalis</i>
Sweetgum	<i>Liquidambar styraciflua</i>

'Godozum' 'Moraine' 'Styraciflua'	
Tulip Tree	<i>Liriodendron tulipifera</i>
Turkish Hazel	<i>Corylus colurna</i>
Willow, Black (open space only)	<i>Salix nigra</i>
Yellowwood	<i>Cladrastis kentuckea</i>

**ORNAMENTAL/UNDERSTORY/
UTILITY-COMPATIBLE (low-growing)**

Common Name	Scientific Name
Amur Maackia	<i>Maackia amurensis</i>
Blackhaw Viburnum (Tree form only)	<i>Viburnum prunifolium</i>
Bladdernut, American (Tree form only)	<i>Staphylea trifolia</i>
Dogwood, Pagoda	<i>Cornus alternifolia</i>
Flowering Crabapple e.g. 'Donald Wyman' 'Prairifire' 'Louisa'	<i>Malus spp.</i>
Hawthorn, Thornless Cockspur	<i>Crataegus crusgalli</i> var. <i>inermis</i>
Hawthorn, Winter King	<i>Crataegus viridis</i>
Hophornbeam, American	<i>Ostrya virginiana</i>
Japanese Tree Lilac	<i>Syringa reticulata</i>
Redbud, Eastern (Tree form only)	<i>Cercis canadensis</i>
Sourwood	<i>Oxydendrum arboretum</i>
Serviceberry (Tree form only)	<i>Amelanchier sp.</i>
Witch Hazel (Tree form only)	<i>Hamamelis virginiana</i>

CONIFERS (open space ONLY, not under wires or as street trees)

Common Name	Scientific Name
Bald Cypress	<i>Taxodium distichum</i>
Fir, Balsam	<i>Abies balsamea</i>
Fir, White	<i>Abies concolor</i>
Hemlock, Eastern	<i>Tsuga canadensis</i>
Larch, American	<i>Larix laricina</i>
Larch European	<i>Larix decidua</i>
Pine, Eastern White	<i>Pinus strobus</i>
Red Cedar, Eastern	<i>Juniperus virginiana</i>
Spruce, Blue	<i>Picea pungens</i>
Spruce, Norway	<i>Picea abies</i>
Spruce, White	<i>Picea glauca</i>

SUMMARY

Tree species selection is dependent on careful assessment of local conditions relative to the requirements and characteristics of a tree species. Variables such as presence of overhead wires and other infrastructure as well as local climatic data need to be considered along with plant characteristics such as diversity of species, invasiveness, hardiness, disease and pest resistance, mature size and form, longevity and aesthetics. No matter whether you are a property owner or a landscape professional, attention to site analysis and proper tree selection will yield healthy long-lived trees.

RECOMMENDATIONS

- Perform a site analysis at every tree planting location to acquire knowledge of site opportunities and limitations
- Select common tree species appropriate to the site
- Avoid planting invasive species
- Use changing climate data to planting choices
- Upon selection and after planting, water the tree twice weekly during each growing season for the first two years to properly establish the root system

Bibliography

Lindsey, P. and Bassuk, N. 1991. Specifying Soil Volumes to Meet the Water Needs of Mature Urban Street Trees and Trees in Containers. *Journal of Arboriculture* 17(6): 141-49

Urban, J. 2008. Up By Roots: Healthy Soils and Trees in the Built Environment. Champaign, IL: International Society of Arboriculture