PURDUE EXTENSION

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EXPERT REVIEWED

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Tree Selection for the "Un-natural" Environment

It's a tough neighborhood for trees in the built environment. It is an ecosystem unlike any other, because it is dynamic, fragmented, high-pressure, and constantly under siege. There are continual extremes and challenges in this "un-natural" area as opposed to the environment in a more natural woodland. It's a place where trees die young, without proper selection, planting and care

Our urban forests are disappearing at an alarming rate in spite of efforts to maintain and plant trees in and around cities. The average lifespan of an urban tree is less than 25 years, suburban trees, less than 50 years. It's no wonder downtown, urban, and suburban areas yield such short-lived trees. Constant construction, poor soil structure, limited soil volume, drought conditions, salt and other chemicals, and temperature extremes all work against a tree's ability to live a long life. It's a wonder they survive at all!

The trees on your street, in your town, or spread throughout your city are part of the urban forest. It is a living, breathing, dynamic, and integral part of urban living. It is an inescapable part of our lives. Trees provide economic, social, and environmental benefits for everyone. Because more people have come to realize this, society is placing greater focus on ways to reduce our impact on the environment. Trees are the perfect biological machine to reduce particulate pollution, reduce storm-water runoff, sequester carbon, and improve air and water quality.

Successful tree selection requires us to think backwards—beginning with the end in mind—to get the right tree in the right place...in the right way. Let's look at some important components of the decision-making process for tree selection.

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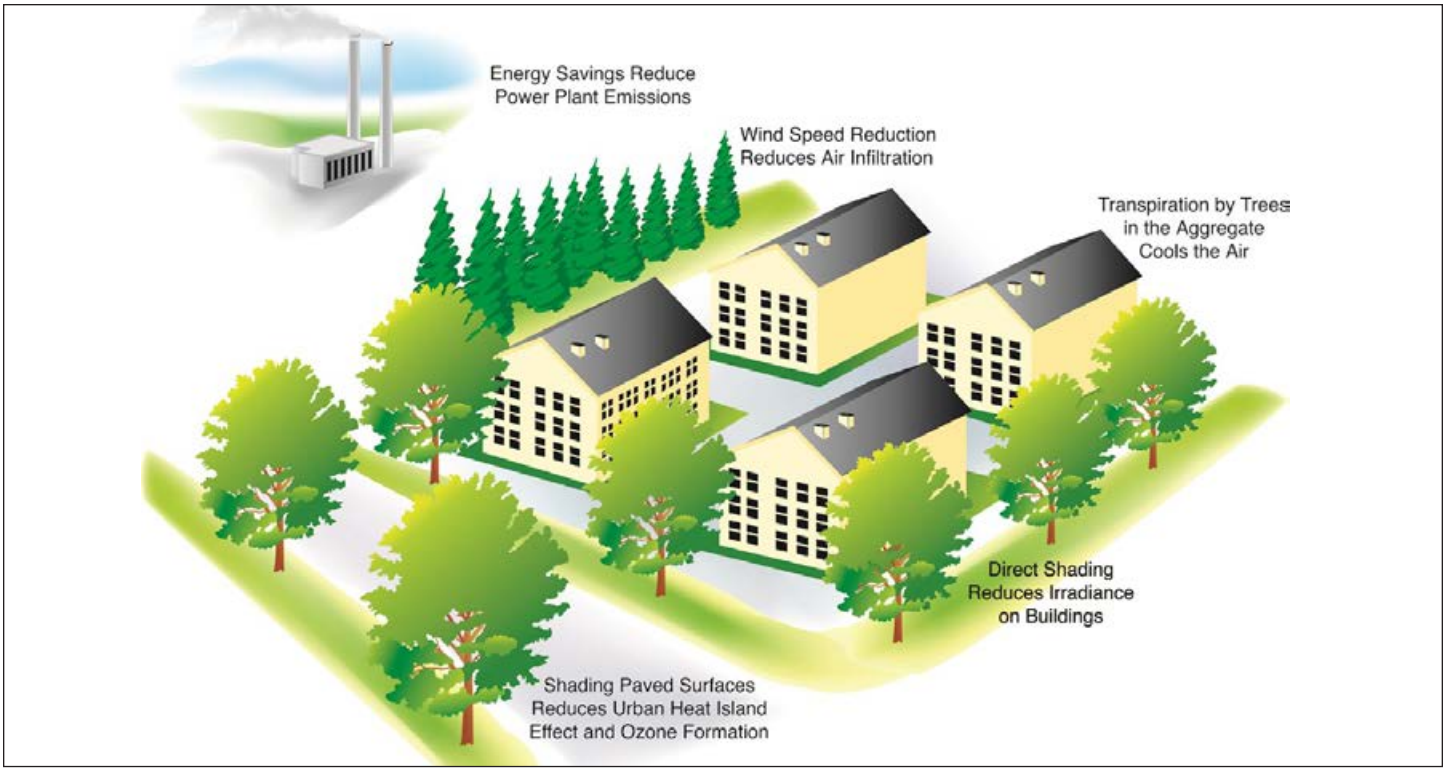
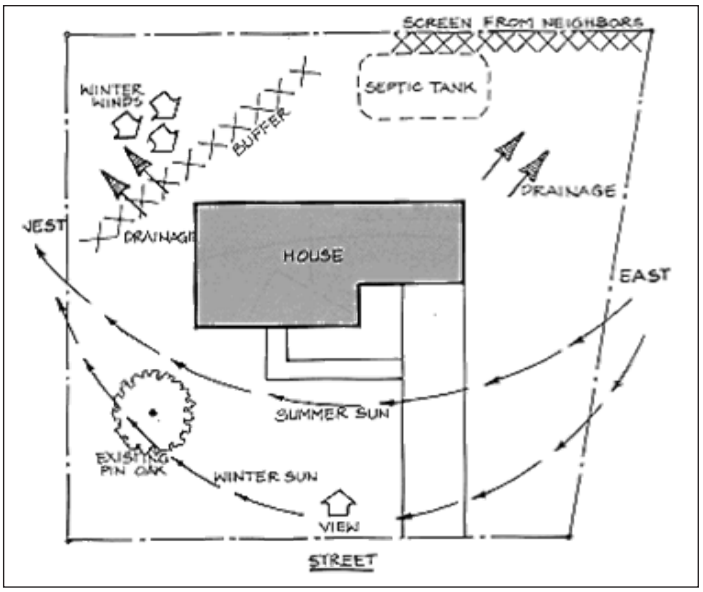


Trees provide many ecosystem services that improve quality of life.

Reason for Planting a Tree

First determine why you are planting a tree. When it comes to tree selection, understanding why you are planting the tree, will help you decide what tree to choose. In other words, knowing if you want the tree is to give you flowers, shade, a screen, a barrier, or a windbreak, will help you choose the best tree species for that role. And one tree might provide numerous environmental and functional benefits on the site for the tree owner. Consider basic landscape functions including beautification, screening of sights, sound barrier, energy conservation, and wildlife habitat. Well-placed shade trees can reduce cooling costs for the home or business, and increase pavement life. Also, properly planned ornamental trees can screen harsh views and reduce traffic noise.

Does it have ornamental value? Consider leaf color, texture, and/or flowers and fruits during the selection process. Some species provide beautiful displays of color for short periods in the spring or fall. Other species have foliage color displays that add interest year-round. Various foliage textures and shapes can also add visual interest with coarse and fine-textured leaves.



A site analysis can help determine proper tree placement.

Consider flowering potential, foliage, and fruit production when selecting a tree.

Trees bearing fruits or nuts provide excellent sources of food for many species of wildlife as well as humans. However, people consider some fruit- and nut-bearing trees to be "dirty" or a nuisance around sidewalks, patios, and streets. These same trees may pose safety and health issues in some situations.

Is the species appropriate for your area? Careful plant selection is the first step in developing a balanced and sustainable landscape. However, plant survival with minimal maintenance is not the only issue in sustainability. We are having more difficulty with invasive exotic plants that have escaped from managed landscapes, displacing native plants and disrupting natural ecosystems. The use of these potential invasives is not sustainable, except in very controlled situations. See the publication ID-464-W for more information on alternative plants for invasive species. The goal for tree installations should be to select and cultivate plants that reduce our impact on the environment, including maintenance.

Each tree has a recommended hardiness zone in which it will survive. Check with local experts to be certain the tree you choose will survive the extremes of your winter. The USDA Hardiness Zone Map can provide the zone for your area. Be aware of microclimates on the site or property, which can be an asset or detriment for trees. Microclimates are localized areas where weather conditions may vary from the norm. A sheltered planting site may support vegetation not normally adapted to a region, while a north-facing slope may be significantly cooler or windier than surrounding areas, limiting the survival potential of normally well-adapted plants.

Current USDA Hardiness Zone Map for Indiana

Source of Plants and Provenance

Choose you tree from a reputable source. "You get what you pay for" applies to trees.

Be sure the trees have been properly handled and maintained in the holding area and not stressed from the start. Professional garden centers and nurseries know how to maintain plants prior to sales to keep them well-watered and cared for while waiting for their new homes. Most

Dedicated nurseries are the best source of trees.

of the large retail stores that handle trees on a seasonal basis will leave them on hot pavement or parking lots with infrequent watering because they have little knowledge of plant needs. This stresses the tree and makes establishment more challenging. Select trees that have good branching structure and are free from defects or pests. Good branch structure creates a healthy, stable, mature tree that is less likely to fail from splitting in wind and storms. Trees with a single, central branch leader system are much stronger than trees with codominant branches.

Whether selecting container-grown, balled-and-burlapped, or bare-root trees, a healthy root system is critical to the future success of the tree. A container-grown tree should be free of girdling roots and other root deformations, while a balled-and-burlapped tree should have visible roots at the edge of burlap. Some container-grown plants are now being produced in pots that correct root girdling, such as copper-treated and air-pruning pots. Purchasing trees from a local nursery may help ensure trees are ecotypes from your area, which will perform better in your particular region.

Container-grown trees are lighter and easier to handle when planting.

Balled-and-burlapped trees provide larger trees, but are heavier than other stock.

Well-Defended Plants

Recently, people have increasingly focused on native plants as the answer to pest issues and for long-term survival. However, native plants do not always guarantee sustainable landscaping nor resistance to insect or diseases. Native plants suffer just as much from pests and decline, especially in the built environment. Besides, there isn't any tree native to the urban environment. In some urban areas many native trees just don't perform well without significant maintenance. Parking lots, lawn strips, and street tree planting areas create growing harsh conditions for any trees. Typically, these spots have limited soil and expose plants to pollution, de-icing salts, and other contaminants. In these cases, non-native, cultivated tree species may be better suited to the poor growing conditions, including soil type, pH, and tolerance to heat.

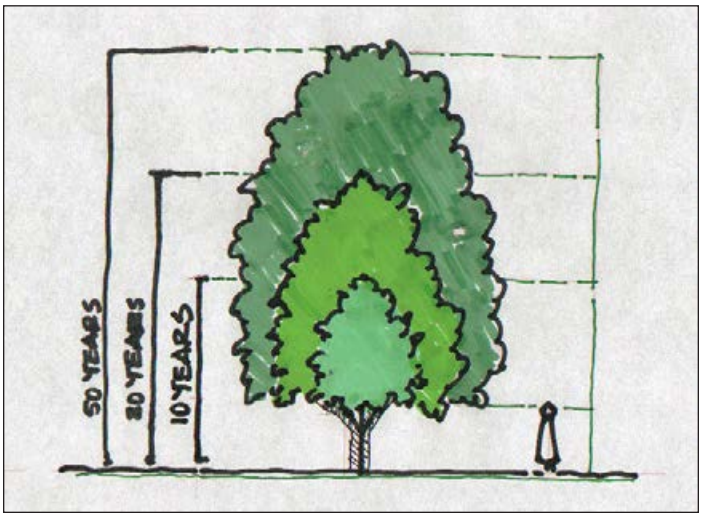
Please, remember that there are more than maples out there! Tree inventories in most of our larger Midwestern cities indicate poor tree diversity. Poor tree diversity in the past led to catastrophic results when there have been invasions by pests such as Dutch elm disease. More currently, emerald ash borer and Asian long-horned beetles have destroyed urban trees. Due to these host-specific pests, entire populations of trees can be wiped out. Central Indiana is nearly 50% maple species and about 10% ash species. With 60% of the tree population composed of two

Harsh urban conditions are challenging to urban tree establishment and survival.

species, certain pest invasions could destroy 6 of every 10 trees. Protect the urban forest: choose trees with diversity in mind!

Don't only think about native trees, but consider monotypic tree selections as well. The fewer the species types a genus has, the less opportunity for pest issues. For example, Kentucky coffeetree (*Gymnocladus dioica*) and katsura tree (*Cercidophyllum japonicum*) have only one species for each and literally no pest issues. One of the most popular and over-planted tree species are the maples (*Acer* sp.) which have over 125 species and over 200 known pests! Species-rich tree genera are prone to many pest problems. Species diversity is not as important as genus diversity; pests attack a genus, not just a species. Native isn't the answer; choose genera with the smallest distribution range and fewest species that seem to be resistant to catastrophic disease and insect issues such as emerald ash borer on ash trees and oak wilt on oak trees.

How big will it get? Unfortunately, many trees are planted and later need to be removed or severely pruned just when they are attaining a functional size. Trees grow and expand way beyond what we can visualize. When planting a small



Trees grow! Determine near-mature size when placing trees around structures.

tree, it is often difficult to imagine that in as few as 10 years it could be shading a large part of the yard. Many of our common landscape trees add over 2 to 3 feet of terminal growth annually! Closely planted trees can have health issues when they conflict with each other. Also, this is expensive and money is wasted by over-planting the site with too many trees, too close. Consider mature size before planting. Inspect the area around the tree-planting site for potential future conflicts with other natural habitat and especially overhead utilities.

Conflicts between trees and utilities can be dangerous and require excessive pruning.

How do I know where it will grow best? The site conditions must be appropriate for the tree or it will not thrive or survive in its new home. Select trees for the location by recognizing the appropriate species relative to hardiness, exposure, soil type, drainage, moisture requirements, and ornamental characteristics.

Exposure to the sun can be a limiting factor in selection. Typically, large, canopy trees prefer full sun allowing the tree to receive all-day exposure to light. Many small, ornamental trees prefer at least partial shade, meaning that some protection from the summer heat or direct sun is important. Refuge from the sun's heat in the afternoon helps to reduce water loss and prevent leaf scorch. If full shade is required by the tree, protection from direct exposure to the sun most of the day is needed for best plant health.

It is important to understand soil plays a major role in tree establishment. Soil conditions are often a limiting factor in success, and selection and planting methods should be adjusted to fit soil types. Heavy, clay soils and compacted soils found in most landscapes require careful thought during the selection and installation process. The water-holding capacity of the soil and drainage are very important. Compacted, clay soils tend to have poor drainage and structure. Trees do not survive prolonged wet conditions, and if soils are poorly drained, adjust your planting protocol to raise the planting space and reduce root exposure to extended wetness.

Knowledge of the site history helps in predicting tree health as well. If you know that the soils are disturbed and fragmented or compacted from previous construction, you can provide remedial action to better condition the soil prior to planting, such as aeration to improve air and water exchange. Take into consideration exposure to other contaminants such as de-icing salts or other chemicals that can affect soil health when planting next to a busy road or highway.

The pH of the soil and water used for supplemental irrigation is important to know in advance as well. The pH can be an indicator of nutrient availability in the soil. Most trees prefer a slightly acidic soil, which allows better element availability to the plant. It is helpful to know the pH of the water that the tree will receive to be certain the water source isn't contributing to an unfavorable situation. Get a soil test to determine pH, as well as fertility, to best prepare the tree for its new home.

Plant for the tree's future size, shape, and hardiness. Be sure the tree fits the location, above and below ground. Consider the mature size of the tree and if it will grow on the site without conflicting with site infrastructure, especially utilities. Does the tree have enough room for the canopy to expand naturally without excessive pruning? Is there enough space for the roots to support long-term growth? This is particularly important to consider in urban areas and lawn strips. Large trees need room for roots to stabilize the tree and provide water and nutrition. A tree with an anticipated canopy growth of 30 feet in diameter and a 12 inch-diameter trunk requires a minimum of 1,000 cf of soil. This is the equivalent of just over 30 full-sized pickup truck beds. The less soil volume, the less of a reservoir available to the tree for water and root expansion. Typically, lawn strips should be at least 6 feet wide and 100 feet long to accommodate large-canopy trees and reduce sidewalk, pavement, and curb damage. Smaller, understory trees may survive with less soil area.

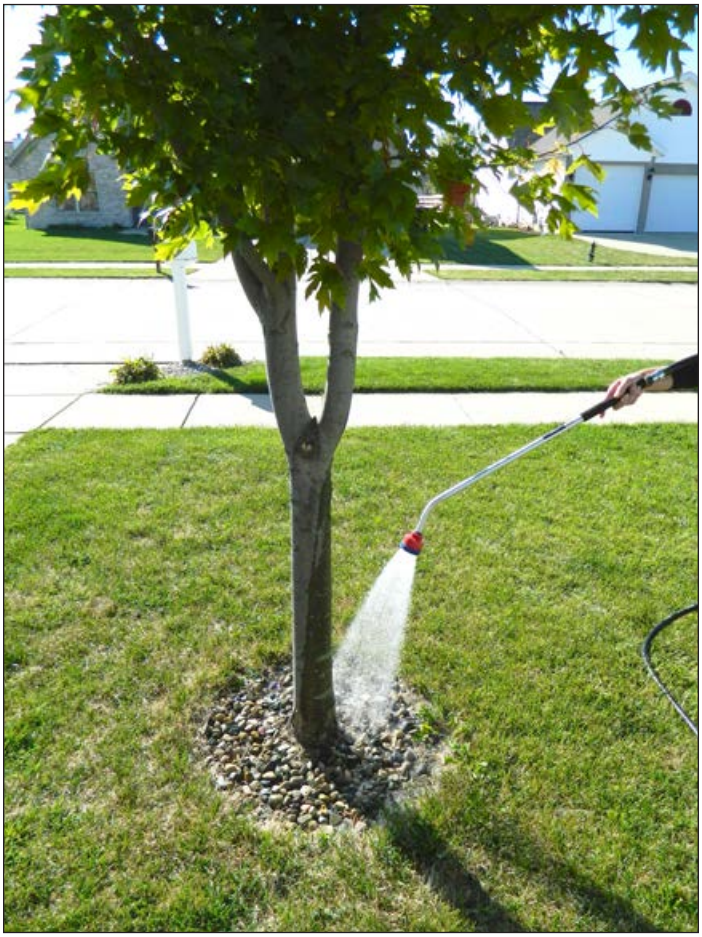
Finally, be sure the tree provides you with the ornamental characteristics you want, such as overall appearance, flowering, fall color, fruit, winter interest with bark, or evergreen color. Trees are important for their functional qualities, but they should complement the landscape and provide visual beauty as well.

Lawn strips should be at least large enough to accommodate growth and root expansion to prevent sidewalk and curb damage.

Trees planted in undersized lawn strips can cause sidewalk heaving, creating trip hazards.

Minimize the Inputs, Maximize the Benefits.

Selecting and planting a tree requires some investment to become well-established and remain healthy. Get the best return on your investment by being realistic about the maintenance you can give the tree. Plan a long-term plant health care program. Know the maintenance requirements for the tree before installation. Don't choose a tree that requires constant care or pest management. For example, flowering dogwoods are excellent trees for partial shade and moist, well-drained soils in an understory application. However, planting a dogwood in the full—in dry, hot conditions such as a front lawn—results in problems such as stress and decline that predisposes the tree to pest issues such as dogwood anthracnose.



Supplemental irrigation is critical for tree survival during dry summers.

Informed Planting Skills

A well-planted and maintained tree will grow faster and live longer than one improperly planted. Good preparation results in sustainable plantings. Be sure to review current best practices for tree installation to prevent future issues with health and stability. For more information, read FNR-433, *Tree Selection and Installation* for details on planting a tree.

Indiana Native Tree List - Suggested for Urban Landscapes

Latin Name	Common Name	Shade Tolerance	Flood Tolerance	Habitat
Acer rubrum	Red Maple	Tolerant	Tolerant	Lowland wet
Acer saccharinum	Silver Maple	Intermediate	Tolerant	Lowland wet
Acer saccharum	Sugar Maple	Very tolerant	Intolerant	Upland mesic
Aesculus glabra	Ohio Buckeye	Intermediate	Intermediate	Lowland wet-mesic
Amelanchier canadensis	Shadblow Serviceberry	Very tolerant	Intolerant	Upland mesic
Amelanchier laevis	Allegany Serviceberry	Very tolerant	Intolerant	Upland mesic
Betula nigra	River Birch	Tolerant	Tolerant	Lowland wet
Carpinus caroliniana	American Hornbeam	Very tolerant	Intolerant	Upland mesic
Carya illinoensis	Pecan	Intolerant	Intermediate	Lowland wet-mesic
Carya laciniosa	Shellbark Hickory	Intolerant	Tolerant	Lowland wet-mesic
Carya ovata	Shagbark Hickory	Intermediate	Intolerant	Upland mesic-dry
Celtis occidentalis	Common Hackberry	Intermediate	Intermediate	Lowland wet-mesic
Cercis canadensis	Eastern Redbud	Tolerant	Intermediate	Lowland wet-mesic
Cladrastis lutea	American Yellowwood	Tolerant	Intolerant	Upland mesic
Cornus alternifolia	Pagoda Dogwood	Very tolerant	Intermediate	Lowland wet-mesic
Cornus florida	Flowering Dogwood	Very tolerant	Very intolerant	Upland mesic
Crataegus crusgalli	Cockspur Hawthorn	Intolerant	Intermediate	Upland dry
Crataegus mollis	Downy Hawthorn	Intolerant	Intermediate	Upland dry
Crataegus phaenopyrum	Washington Hawthorn	Intolerant	Intermediate	Upland dry
Diospyros virginiana	Common Persimmon	Intolerant	Intermediate	Lowland wet-mesic
Euonymus atropurpureus	Eastern Wahoo	Tolerant	Intermediate	Lowland wet-mesic
Fagus grandifolia	American Beech	Very tolerant	Very intolerant	Upland mesic
Gledistia triacanthos	Honey Locust	Intolerant	Intermediate	Lowland wet-mesic
Gymnocladus dioicus	Kentucky Coffeetree	Intolerant	Intermediate	Lowland wet-mesic
Juniperus virginiana	Eastern Red Cedar	Very intolerant	Intolerant	Upland dry
Liquidambar styraciflua	American Sweetgum	Intolerant	Tolerant	Lowland wet-mesic
Liriodendrun tulipifera	Tulip Poplar	Intermediate	Very intolerant	Upland mesic
Nyssa sylvatica	Black Tupelo	Intolerant	Intermediate	Lowland wet-mesic
Ostrya virginiana	Hophornbeam	Very tolerant	Very intolerant	Upland mesic-dry
Pinus strobus	Northern White Pine	Intermediate	Intolerant	Upland mesic
Platanus occidentalis	American Sycamore	Intermediate	Intermediate	Lowland wet-mesic
Prunus americana	American Plum	Intolerant	Very intolerant	Upland dry-mesic
Quercus alba	White Oak	Intermediate	Intolerant	Upland mesic-dry
Quercus bicolor	Swamp White Oak	Intermediate	Tolerant	Lowland wet
Quercus borealis (rubra)	Northern Red Oak	Tolerant	Intolerant	Upland mesic-dry
Quercus imbricaria	Shingle Oak	Intermediate	Intermediate	Lowland wet-mesic
Quercus macrocarpa	Bur Oak	Intolerant	Intermediate	Wet-mesic
Quercus muhlenbergi	Chinkapin Oak	Intolerant	Very intolerant	Upland dry
Quercus shumardii	Shumard's Oak	Intolerant	Tolerant	Lowland wet-mesic
Rhus aromatica	Fragrant Sumac	Very intolerant	Very intolerant	Upland dry
Rhus glabra	Smooth Sumac	Very intolerant	Intolerant	Upland mesic-dry
Rhus typhina	Staghorn Sumac	Very intolerant	Intolerant	Upland dry
Sassafras albidum	Common Sassafras	Intolerant	Very intolerant	Upland dry
Staphylea trifolia	American Bladdernut	Very tolerant	Intermediate	Lowland wet-mesic
Taxodium distichum	Bald Cypress	Intolerant	Tolerant	Lowland wet-mesic
Tilia americana	Basswood	Very tolerant	Intolerant	Upland mesic
Tsuga canadensis	Eastern Hemlock	Very tolerant	Very intolerant	Upland mesic-dry

HABITAT KEY

Lowland wet: River margin and streamside floodplain depressions, areas subject to frequent and violent inundation due to cyclic flooding in late winter and spring, high water tables, lake margin and swamp, slow draining flats and depressions, sluggish streams, areas of poor internal or surface drainage supporting standing water much of the time, cool areas with high humidity and high water table.

Lowland wet-mesic: Alluvial bottomlands and elevated terraces of major streams, where soil moisture supply is in excess of that falling as rain; areas of intermittent yearly flooding of short duration, characterized by excess surface wetness in winter and spring to nearly xeric conditions during midsummer low water stages.

Upland mesic: Wet ravines and sheltered coves, moist but well-drained slopes and uplands, generally north- and east-facing slope aspects. Protection from direct sun exposure and to prevailing dry winds, together with cool air drainage into these areas, maintains a regime of greater available soil moisture, reduced evaporation stress and stable temperature near the ground.

Upland mesic-dry: Dry slopes and upland flats, generally warmer south and facing slope aspects, upland ridges and ravines. Direct sun exposure accelerates evaporation stress, reduces available soil moisture and greatly increases temperature near the ground.

Upland dry: High banks, calcareous waterworn cliffs, steep rocky land, excessively drained sandy soils or shallow stoney soils over rock outcrop.

REFERENCES

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Hightshoe, G. 1988. "Native Trees, Shrubs, and Vines for Urban and Rural America: A Planting Design Manual for Environmental Engineers."
Tungesvick, Spence Nursery

Utility-Friendly Tree List

The following list includes overhead utility friendly (low-growing) tree species which may be compatible in areas of overhead utility lines. This list is not all-inclusive. Other species may be acceptable and each selection should be considered for mature size in relationship to the height of the overhead lines. Consult a utility forester or your provider for assistance. Be sure to comply with local regulations and ordinances. Size noted is typical for urban conditions; mature sizes should be less than 20 feet in most applications.

Species	H'	W'	Shape	Light	Description
Paperbark Maple (*Acer griseum*)	25	20	Upright, oval to rounded	Full sun to part shade	Trifoliate leaves, bright red and orange fall color; cinnamon brown to reddish brown exfoliating bark.
Shadblow Serviceberry (*Amelanchier canadensis*)	20	20	Oval to rounded	Full sun to part shade	White flowers in spring; red to purple fruit; yellow mixed with a little orange fall color.
Apollo Maple *Acer saccharum "Barrett Cole"*	25	10	Narrow, columnar	Full sun to part shade	Unique narrowness, dense branching and compact form make this dwarf and columnar Sugar Maple ideal for limited spaces. Dark green foliage withstands summer heat.
Autumn Brilliance Serviceberry (*Amelanchier x grandiflora* "Autumn Brillance")	20	20	Rounded	Full sun to part shade	White flowers in spring; red to purple fruit; orange to red fall color.
Allegheny Serviceberry (*Amelanchier laevis*)	20	20	Upright, irregular	Full sun to part shade	White flowers in spring; red to purple fruit; late yellow to orange fall color.
Eastern Redbud (*Cercis Canadensis*)	25	25	Upright, spreading	Full sun to part shade	Early pink flowers along twig before foliage; heart-shaped leaves.
Pagoda Dogwood (*Cornus alternifolia*)	20	20	Rounded	Full sun to part shade	Horizontal branching; creamy-white flowers followed by blue-black fruit; red to purple fall color.
Cornelian Cherry Dogwood (*Cornus mas*)	20	15	Rounded	Full sun to part shade	Early yellow flowers before foliage; bright red fruit in summer.
Cockspur Hawthorn (*Crataegus crus-galli*)	20	20	Broad, rounded	Full sun	Showy, white flowers; red fruit; glossy foliage; thorny; attracts birds.
Thornless Cockspur Hawthorn (*var. inermis*)	20	20	Broad, rounded	Full sun	Thornless; other characteristics same as species.
Washington Hawthorn (*Crataegus phaenopyrum*)	25	25	Upright, spreading	Full sun	White flowers; showy, orange-red fruit; red-orange fall color; narrow thorns.
Royal Star Magnolia (*Magnolia kobus var. stellata* "Royal Star")	15	15	Oval to rounded	Full sun to part shade	White flowers with pink in early spring before leaves.
Crabapple (*Malus spp.*)					
"Sugar Tyme"	20	15	Upright, oval	Full sun	Pink buds; white flowers; red fruit.
"Centurion"	20	15	Upright	Full sun	Pink to red flowers; red fruit; red to bronze foliage.
"Donald Wyman"	20	25	Broad, rounded	Full sun	Pink to red buds open to white flowers; red fruit.
"Indian Summer"	15	15	Rounded	Full sun	Red buds; rose-red flowers; red fruit.
"Snow Drift"	20	15	Rounded	Full sun	Red bud; white flowers; small red fruit.
"Prairiefire"	20	20	Upright, rounded	Full sun	Pink flowers; red fruit.
Ivory Silk Japanese Tree Lilac (*Syringa reticulata*)	20	15	Rounded	Full sun	Creamy panicles of fragrant flowers in late spring; red-brown shredding bark.
Techny Arborvitae *Thuja occidentalis*	15	6	Upright, pyramidal	Full sun to part shade	Fast growing and dark green. Excellent for screens and tall sheared hedges. Good in sun or light shade. Very winter hardy.
Keteleeri Juniper Juniperus chinensis "Keteleeri"	20	10	Upright, pyramidal	Full sun	Dense evergreen tree with medium green, mostly scale-like foliage which is attractive year-round. This is a female cultivar that produces profuse, grayish-green, berry-like cones.
Hetz Columnar Juniper *Juniperus chinensis "Hetzii Columnar"*	15	8	Upright, pyramidal	Full sun	Multi-stemmed evergreen tree with bright green foliage and abundant bluish-green berries.

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