

Alternatives to Ash Trees for the Urban Landscape

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Emerald ash borer (EAB) has destroyed millions of trees throughout the U.S. and Canada. Many cities suffered huge losses in their urban and suburban tree canopies as ash populations were very high. For some municipalities, 80-100% or more ash trees have died from EAB. A broader tree diversity using both native and non-native species could help guard against the real possibility of large-scale devastation by exotic pests and diseases. In addition to exotic pests, trees growing in urban conditions are subject to drought, excessive heat, air pollution, road salt, poorly drained, compacted soils with high pH and low fertility. These extreme conditions are often not conducive to growing many plants, particularly native trees that grow naturally in fertile, moist forests. The list below is a summation of non-invasive trees that have been used successfully in urban conditions. Urban foresters, arborists, landscapers and homeowners can replant areas devastated from EAB with the below EAB resistant species. Not all tree species tolerate all urban conditions mentioned above, but have an improved chance of successfully establishing than more sensitive species.

Before we choose a specific tree, Wisconsin DNR Urban Forestry has established guidelines for tree planting in a city to help avoid another major tree catastrophe like EAB. These guidelines include recommendations for people employed in the nursery and landscape industries and homeowners.

Example one: Betulaceae family

Plant no more than 20% of trees representing a plant family: i.e. Betulaceae (includes alders (*Alnus* spp.), birches (*Betula* spp.), hornbeams (*Carpinus* spp.), hazelnuts (*Corylus* spp.) and ironwood (*Ostrya* spp.).

Plant no more than 10% of trees from a genus within a family: i.e. *Betula lenta*, *Ostrya virginiana*, *Carpinus caroliniana*, *Corylus colurna* (these are all in the Betulaceae family).

Plant no more than 5% of trees from a species or cultivar within a genus: i.e. *Betula lenta*, *Betula nigra*, *Betula papyrifera*, or *Betula populifolia* (all birches or *Betula* spp.).

Example two: Sapindaceae family

The Sapindaceae family includes maples (*Acer* spp., formerly in Aceraceae family), buckeyes and horsechestnuts (*Aesculus* spp., formerly in Hippocastanaceae family), golden rain-tree, (*Koelreuteria paniculata*), yellowhorn (*Xanthoceras sorbifolium*) and western soapberry (*Sapindus drummondii*), etc. With 20% of your urban forest representing trees in the Sapindaceae family, there should only be 10% of a genus within the Sapindaceae family, such as maple (*Acer* spp.) with only 5% of those maple trees from a certain species, such as Freeman maple (*Acer ×freemanii*). There are many different species of maples (i.e. red, silver, Freeman, Norway, sugar, Amur maples, etc.) that are used in landscaping, unfortunately, there are too many of them which may become problematic in the future. A devastating insect or disease could destroy maples throughout the eastern U.S. and Canada, similar to what happened to millions of ash trees (*Fraxinus* spp.) due to emerald ash borer and elm trees (*Ulmus* spp.) due to Dutch elm disease.

Example three: Rosaceae family

The Rosaceae family is very large and includes many genera and species. Trees within the rose family include serviceberries (*Amelanchier* spp.), hawthorns (*Crataegus* spp.), ornamental crabapples and apples (*Malus* spp.), cherries, peaches, plums, apricots (*Prunus* spp.), pears (*Pyrus* spp.) and mountainashes (*Sorbus* spp.), etc. With 20% of an urban forest representing trees in the Rosaceae family, there should only be 10% of a genus within the Rosaceae family, such as hawthorns (*Crataegus* spp.) with only 5% of those hawthorn trees from a certain species (i.e. Washington, downy, cockspur, or 'Winter King' hawthorns).

Large to medium-sized street or park trees tolerant to moderately tolerant to urban conditions

***Acer ×freemanii*: Freeman maple**; hardy to zone 3b-4a (depends on cultivar); 40-60' tall, 35-40' wide; oval to rounded form with ascending branches; fast grower; showy yellow, orange to red fall color that varies with cultivar; smooth, light gray bark when young that darkens and becomes furrowed with age; dioecious (fruit occurs on female trees only) and is cultivar dependent; red turning brown fruit in spring, not fall; overused species and should be used less to prevent another catastrophic pest from wiping out the population; adaptable to most soils and pH, but at high pH, it can get chlorotic and is cultivar

dependent; tolerant to clay and wet soil; moderate drought and salt tolerance; easy to transplant; can be bareroot transplanted; dig in spring only; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; prone to developing girdling roots if planted too deeply; prone to included bark formation; needs pruning when young to develop a central leader and good branch structure; native to WI as it is a natural hybrid of red (*Acer rubrum*) and silver (*Acer saccharinum*) maples; because it is a hybrid, soil pH tolerance does vary with cultivar as some respond more like its red maple parentage; Sapindaceae family (formerly Aceraceae family)

'AF#1' (FIREFALL™): hardy to zone 3b; 45-50' tall, 30-35' wide; upright to spreading form; deeply lobed leaves; early, bright orange-red to red fall color; male cultivar so no fruit; has better branch crotch angles, less included bark formation

'Bailston' (MATADOR™): hardy to zone 4a; 45-50' tall, 30-40' wide; symmetrical, upright to oval form; fast grower; late, orange-red to deep red fall color; not sure if male or female cultivar

'Celzam' (CELEBRATION®): hardy to zone 4a; 50-55' tall; 35-40' wide; broadly oval form; deeply lobed leaves; yellow to poor fall color; fast grower; mainly a male cultivar, but can produce some fruit; has better branching, wider branch crotch angles; straight, central leader

'DTR 102' (AUTUMN FANTASY®): hardy to zone 4a; 50' tall, 40' wide; broadly oval form with upright branches opening with age; deeply lobed leaves; bright red fall color; female cultivar so does produce fruit

'Ed Gartner' (REDHEAD™): hardy to zone 3b; 50' tall, 30' wide; dense, rounded form with upright branches; fast grower; red fall color; male cultivar so no fruit; more tolerant to high pH than some other cultivars

'Jeffersred' (AUTUMN BLAZE®): hardy to zone 3b, 50-60' tall, 40' wide; broadly oval form with upright branches; deeply lobed leaves; orange-red to red fall color; male cultivar so no fruit, but can revert; prone to included bark formation and limb breakage in storms; needs training pruning when young to develop central leader and good branch structure; overused cultivar

'Marmo': hardy to zone 3b; 55-65' tall, 40-45' wide; upright, oval form; variable to poor fall color from yellowish to orange with a bit of red; male cultivar so no fruit

'Sienna' (SIENNA GLEN®): hardy to zone 3b; 50-60' tall, 35-40' wide; pyramidal form with straight, central leader; becoming broadly oval with age; wider, branch crotch angles; variable, rusty-orange to burgundy fall color; male cultivar so no fruit; selection is from northern MN

Acer hybrids: hybrid maple cultivars hardy to zone 4b-5a; height, width and form varies with cultivar; dark green, glossy leaves; late, fall color varies with cultivar and may not develop early enough; adaptable to most, well-drained soils and pH; drought, air pollution, urban and heat tolerant; moderate salt tolerance; easy to transplant; hybrid origin; good alternative to larger trees for smaller spaces; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; hybrid origin of Shantung (*Acer truncatum*) and Norway (*Acer platanoides*) maples; Sapindaceae family (formerly Aceraceae family)

'Keithsform' (NORWEGIAN SUNSET®): hardy to zone 4b; 35-40' tall, 25' wide; oval form; late, yellow-orange to red fall color; good branching and uniform tree canopy

'Warrenred' (PACIFIC SUNSET®): hardy to zone 5a; 30-35' tall, 25' wide; upright, spreading, rounded form; late, bright yellow-orange to red fall color

'JFS-KW202' (CRIMSON SUNSET®): hardy to zone 4b; 30-35' tall, 25' wide; upright, oval form; deep purple leaves during the growing season resembling 'Crimson King' Norway maple, but is a smaller tree; late, maroon to bronze fall color

'JFS-KW249' (RUBY SUNSET®): hardy to zone 4b; 25-30' tall, 20' wide; broadly oval to rounded form; late, deep red fall color

'JFS-KW187' (URBAN SUNSET®): hardy to zone 4b; 35' tall, 20' wide; narrow, pyramidal to upright-oval form; late, deep red fall color; uniform tree canopy

Acer miyabei: Miyabe maple; hardy to zone 4a; 50-55' tall, 35-40' wide; dense, upright-oval form with ascending branches; dark green leaves; late, pale yellow fall color; grayish, scaly bark in long strips; adaptable to most well-drained soils and pH; drought, urban and heat tolerant; moderate salt tolerance; can be bareroot transplanted; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; prone to developing girdling roots if planted too deeply; native to Japan; Sapindaceae family (formerly Aceraceae family)

'Morton' (STATE STREET®): hardy to zone 4a; 50' tall, 35-40' wide; dense, upright, oval form with ascending branches; branching often starts higher up trunk than species

'JFS-KW3AM' (RUGGED RIDGE®): hardy to zone 4a; 55' tall, 35-40' wide; dense, upright, oval form; more vigorous; deeply furrowed, corky bark

***Acer rubrum*: red maple**; hardy to zone 3b to 5a (depends on cultivar); 40-60' tall, 35-40' wide; oval, rounded to irregular form (depends on cultivar); moderate to fast grower; fall color is variable from early, yellow to later orange to bright red fall color; smooth, light gray bark when young that darkens and becomes furrowed with age; dioecious (fruit occurs on female trees only) and is cultivar dependent; red turning brown fruit in spring, not fall; overused species and should be used less to prevent another catastrophic pest from wiping out the population; adaptable to most soils, clay and wet soil tolerant (most cultivars), but intolerant to high pH soils and will develop chlorosis; requires acidic to neutral soil pH only; intolerant to drought, air pollution and road salt; easy to transplant; can be bareroot transplanted; dig in spring only; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; susceptible to leaf hoppers, cankers, frost crack and sunscald on trunks; prone to developing girdling roots if planted too deeply; prone to included bark formation; needs pruning when young develop a central leader and good branch structure; native to WI; Sapindaceae family (formerly Aceraceae family)

'Armstrong': hardy to zone 4; 40-45' tall, only 15' wide; narrow, open, fastigate form; poor fall color, only yellowish; lighter gray bark; female cultivar so does produce fruit; intolerant to high pH; used to be designated as a Freeman maple cultivar, but it is now considered a red maple cultivar

'Autumn Flame': hardy to zone 3b; 35-40' tall, 35' wide; dense, rounded form with spreading branches; smaller leaves; early, bright red fall color; male cultivar so no fruit

'Autumn Radiance': hardy to zone 4; 40-50' tall, 35-40' wide; upright oval to dense, rounded form; ascending branches with tight branch crotch angles and included bark formation; early, orange-red to red fall color; female so produces fruit

'Autumn Spire': hardy to zone 3b; 40' tall, 30' wide; broad, columnar form; early, bright red fall color; selection from northern MN; male cultivar so no fruit

'Bailcraig' (SCARLET JEWELL™): hardy to zone 3b; 50' tall, 30-40' wide; upright pyramidal becoming broadly oval form; fast grower; early, orange to deep, crimson-red fall color; selection is from northern MN

'Bowhall': hardy to zone 4; 40' tall, only 15' wide; narrow, oval to upright form; yellow orange to reddish-orange fall color; female cultivar so does produce fruit; susceptible to producing narrow, branch crotch angles with included bark formation; intolerant to dry soil and high soil pH

'Brandywine': hardy to zone 4; 40' tall, 30' wide; pyramidal to oval form; darker green leaves; late, deep red to purplish-red fall color that is long lasting; male cultivar so no fruit; has better leafhopper resistance

'Frank Jr. (REDPOINTE®)': hardy to zone 5 only; 45-50' tall, 30' wide; upright, broad, pyramidal form; straight, central leader; faster grower; has better branching than some other red maples; early, bright red fall color; supposedly more tolerant to higher soil pH than other red maple cultivars; female cultivar so produces fruit

'Franksred' (RED SUNSET®)': hardy to zone 4b; 45-50' tall, 35' wide; dense, broad oval form with upright, dense, symmetrical branches; fast grower; dark green, glossy leaves; bright orange-red to red fall color; female cultivar so does produce fruit

'JFS-KW78' (ARMSTRONG GOLD®)': hardy to zone 4; 40' tall, 12-15' wide; narrow, tight, fastigate form; golden yellow fall color, better fall color and denser form than 'Armstrong'; female cultivar so does produce fruit; intolerant to high pH; used to be designated as a Freeman maple cultivar, but it is now considered a red maple cultivar

'Karpick': hardy to zone 4; 40' tall, 25' wide; narrow, upright when young becoming broader with age to a dense, oval form; yellow to orange fall color, male cultivar so no fruit; tight branch crotch angles leading to included bark formation; old cultivar

'Magnificent Magenta' (BURGUNDY BELLE®)': hardy to zone 5 only; 40-45' tall, 35-40' wide; oval to rounded form; symmetrical branching; smaller leaves; late, bright red fall color turning to dark burgundy; tolerates drought and higher pH than other red maple cultivars, but still not tolerant to very high pH

'Indian Summer' (called 'Morgan' in Canada)': hardy to zone 4; 45' tall, 40' wide; broad, upright to oval form; better branch crotch angles; fast grower; early, bright, rosy-red fall color; female cultivar so

produces fruit; sensitive to flooded soils; intolerant to high pH; susceptible to frost cracks and cankers when in the establishment phase after planting

'Northwood': hardy to zone 3b; 40-50' tall, 35' wide; broad, oval to rounded form with symmetrical, ascending branching; fast grower; fair, orange to orange-red fall color; wider branch crotch angles; selection is from northern MN; susceptible to frost cracks and trunk cankers when establishing in landscape; male cultivar so no fruit

'Olson' (NORTHFIRE®): hardy to zone 3b; 50' tall, 30-40' wide; broad-oval form; fast grower; better branching; bright orange to red fall color, selection is from northern MN; female cultivar so produces fruit

'PNI 0268' (OCTOBER GLORY®): hardy zone 5b only; 40-50' tall, 35-40' wide; broadly oval to rounded form; glossy leaves; late, dark red to reddish-purple fall color that is long lasting; female cultivar so does produce fruit; does better in the southern U.S.

'Polara' (RUBY FROST™): hardy to zone 3b; 40-45' tall, 40' wide; broad, oval form; bright watermelon-red fall color; selection is from WI; intolerant to high soil pH; female cultivar so produces fruit

'Red Rocket': hardy to zone 3b; 35-40' tall, 10-15' wide; narrow, upright to columnar form; slower grower than other narrow red maple cultivars; bright orange-red fall color, male cultivar so no fruit; selection is from northern MN

'Scarsen' (SCARLET SENTINEL®): hardy to zone 4; 40-50' tall, 20' wide; stiff, upright to oval form; flares outward higher in tree; fast grower; poor fall color only yellow-orange to orange; female cultivar so produces fruit; intolerant to high soil pH; may be a cultivar of Freeman maple

'Schlesingeri': hardy to zone 5; 45' tall, 35' wide; upright, spreading form; has wider branch crotch angles; fast grower; early, orange-red to purplish-red fall color; male cultivar so no fruit; older cultivar

'Somerset': hardy to zone 4; 45' tall, 35' wide; pyramidal when young becoming oval with age; good branch structure; deep red fall color; male cultivar so no fruit

'Sun Valley': hardy to zone 5b only; 40' tall, 30-35' wide; oval, symmetrical, dense form; smaller leaves; early, bright orange-red to red fall color; male cultivar so no fruit

***Acer saccharum*: sugar maple**; hardy to zone 3a-5b (depends on cultivar); 60-75' tall, 40-50' wide; upright oval to rounded form; moderate growth rate; very showy, bright yellow, orange and/or red fall color; one of the best trees for fall color; some cultivars color earlier than others; smooth, gray bark when young becoming dark brown to black and furrowed into long, flat, vertical plates; smaller fruit; full sun to partial shade; requires a fertile, loamy, moist, well-drained soil; intolerant to poorly drained, dry, compacted, heavy clay soils, however, cultivars below are more urban and heat tolerant; pH adaptable; intolerant to road salt and air pollution; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; susceptible to frost cracks, cankers and sunscald on trunks; prone to developing girdling roots and basal/root rot if planted too deeply; can get leafhoppers; leaf scorch during drought; can bareroot transplant; native to WI; tree sap tapped in early spring for maple syrup production; Sapindaceae family (formerly Aceraceae family); many cultivars available, but ones below are particularly more heat and drought tolerant

'Autumn Splendor': hardy to zone 5a; 45' tall, 40' wide; broadly oval to rounded form; tree selected from provenance growing in Caddo Mountains in southeastern Oklahoma; glossy, green leaves; bright, orange-red fall color; resistant to heat, drought and leaf tatters; use in far southern WI

'Bailsta' (FALL FIESTA®): hardy to zone 3b; 50-70' tall, 45-50' wide; upright, oval to rounded, symmetrical form; fast grower; glossy, leathery, dark green leaves; excellent, bright yellow-orange and red fall color; leaf tater and leafhopper resistant; resistant to sunscald; may get frost cracks; resistant to Japanese beetles; more heat tolerant

'Hiawatha 1' (OREGON TRAIL®): hardy to zone 5a; 45' tall, 40' wide; broadly oval to rounded form with good branch structure; tree selected from a northeastern Kansas provenance; dark green leaves; orange-red to red fall color; leaf tatter resistant, heat tolerant

'JFS-Caddo2' (FLASHFIRE®): hardy to zone 5a; 45' tall, 40' wide; broad-oval form; tree selected from provenance growing in Caddo Mountains in southeastern Oklahoma; dark green leaves; early, bright red fall color; good resistance to powdery mildew; heat and drought tolerant; leaf tatter resistant; use in far southern WI

'JFS-KW8' (AUTUMN FEST®): hardy to zone 4; 50' tall, 35' wide; upright-oval form; dark green, thick leaves; early, orange red to bright red fall color; faster grower; improved heat and drought tolerance

'John Pair': hardy to zone 5a; only 30' tall and wide; symmetrical, broad, rounded form; tree selected from provenance growing in Caddo Mountains in southeastern Oklahoma; glossy, green leaves; red fall color; heat tolerant; susceptible to powdery mildew; use in far southern WI

'PNI 0285' (GREEN MOUNTAIN®): hardy to zone 3b; 50' tall, 40' wide; broadly oval form; reddish-orange to red fall color; resistant to leaf scorch; heat tolerant; faster grower; resistant to Japanese beetles

'Reba' (BELLE TOWER®): hardy to zone 5a; 45' tall, 18-20' wide; narrow, upright form to columnar; bright green leaves; yellow-orange fall color; from a southern Tennessee provenance; heat and high humidity tolerant; slow grower

'Sisseton' (NORTHERN FLARE®): hardy to zone 3a; 50' tall, 40' wide broadly oval form; tree selected from provenance growing in northeastern South Dakota; dark green, thick leaves; orange-red color; heat and drought tolerant; resistant to leaf tatters

'Whit XLIX' (POWDER KEG®): hardy to zone 5a; 50' tall, 40' wide; upright oval becoming rounded with age; tree selected from provenance growing in Caddo Mountains in southeastern Oklahoma; dark green, leathery leaves; bright orange-red fall color; heat and drought tolerant

subsp. *nigrum*: black maple, hardy to zone 4a; 50-60' tall, 35-50' wide; upright, oval to rounded form; used to be called *Acer nigrum*, but now is considered a subspecies of sugar maple; same cultural requirements as sugar maple above, similar in identification characteristics as sugar maple except it usually has three lobes, sometimes five lobed; leaf tips droop downward and may have pubescence on backside of leaves and on petiole; thicker, leathery leaves; yellow to apricot-orange fall color; more heat and drought tolerant than most sugar maples; can get leaf tatters; native to WI

'Greencolumn': hardy to zone 4a; 50-70' tall, 20-25' wide; upright, narrow form; straight, central leader; slow grower; lighter green leaves; yellow, orange to apricot fall color; heat tolerant and more tolerant to drought

***Celtis occidentalis*: common hackberry**; hardy to zone 3b; 50-70' tall, 40-60' wide; vase-shaped when young becoming rounded with age with arching branches; yellow to yellowish-green fall color; gray to tan, corky, warty looking bark; small, purplish-black fruit not a litter problem; fruit attracts birds; adaptable to dry, clay, rocky and sandy soils and high pH; air pollution, heat, urban, drought and wet soil tolerant; intolerant to road salt; sensitive to juglone; susceptible to hackberry nipple gall on leaves, but is only cosmetic; susceptible to Asian longhorn beetles and witches brooming on twigs (due to Eriophyid mite and powdery mildew fungus); prone to included bark formation; needs pruning when young to develop a central leader and good branch structure; do not bareroot transplant; transplants poorly from containers; native to WI; Cannabaceae family (formerly Ulmaceae family)

'Chicagoland': hardy to zone 3b; 40-50' tall, 50' wide; upright-oval growth with a single, straight, terminal leader; cultivar is harder to find in nurseries

'JFS-KSU1' (PRAIRIE SENTINEL®): hardy to zone 4; 45' tall, only 12' wide; columnar to fastigate form

'Windy City': hardy to zone 3b; 40-60' tall and wide; upright, spreading form with a single, straight, terminal leader; golden yellow fall color; faster growing; cultivar is harder to find in nurseries

***Corylus colurna*: Turkish hazelnut, Turkish filbert**; hardy to zone 4; 40-50' tall, 25-30' wide; dense, broad, pyramidal form; no fall color; showy, long, pendulous catkins in early spring; scaly to flaky bark becoming ridged; may produce edible nuts if planted near another Turkish hazelnut tree; fruit attracts wildlife; difficult to transplant; adaptable to most well-drained soils and pH; air pollution, heat, urban and drought tolerant; intolerant to wet, poorly drained soil and road salt; susceptible to eastern filbert blight and Japanese beetles; root rot in poorly drained soil; some difficulties with bareroot transplanting, but there has been good success with it; native to southeastern Europe and western Asia; Betulaceae family

***Ginkgo biloba*: ginkgo, maidenhair tree**; hardy to zone 4a; 50-70' tall, 30-60' wide; pyramidal when young becoming wide-spreading with age to upright (depends on cultivar); distinct, bright green, fan-shaped leaves with straight leaf veins; tip of leaf may be notched; showy, bright golden-yellow to yellow fall color; a gymnosperm and female trees produce undesirable, 1-2" long, orangish-tan arils with very foul odor due to its fleshy seed coat; plant male cultivars only (see below) to avoid any arils and "fruit" litter; adaptable to most, well-drained soils and pH; drought, air pollution, heat and urban tolerant; moderate

salt tolerance; no pest problems; deer resistant tree; do not bareroot transplant; native to eastern China; Ginkgoaceae family

'Autumn Gold': hardy to zone 4a; 45-50' tall, 35' wide; broadly pyramidal to oval, symmetrical form; male cultivar; fruitless

'Blagon' (GOLDSPIRE™): hardy to zone 4a; 45' tall and only 12' wide; dense, tightly fastigate form creates a symmetrical, narrow spire; male cultivar; fruitless

'JFS-UGA2' (GOLDEN COLONNADE®): hardy to zone 4a; 45' tall, 25' wide; narrow, upright-oval form; strong, central leader; male cultivar; fruitless

'Magyar': hardy to zone 4a; 50' tall, 25' wide; narrow, pyramidal form; faster growing than PRINCETON SENTRY®; male cultivar; fruitless

'PNI 2720' (PRINCETON SENTRY®): hardy to zone 4a; 40-50' tall, 15-20' wide; narrow, upright, pyramidal form; male cultivar; fruitless

'Saratoga': hardy to zone 4a; 30-40' tall, 20-30' wide; compact, dense, rounded form; pendulous leaves; slower and smaller than other ginkgos; male cultivar; fruitless

'The President' (PRESIDENTIAL GOLD®): hardy to zone 4a; 50' tall, 40' wide; broadly pyramidal to upright-oval form; densely branched; straight, central leader; male cultivar; fruitless

***Gleditsia triacanthos f. inermis*: thornless honeylocust**; hardy to zone 4a; 50-70' tall, 40-50' wide; vase-shaped form becoming flat-topped and spreading with age; fine textured, small leaves; showy, early, bright golden-yellow fall color; cultivars below have no thorns; plant male cultivars (see below) to avoid messy fruit on female trees; tolerant to most soils and pH; heavy clay, drought, road salt, periodic flooding and urban tolerant; can be bareroot transplanted; susceptible to leafhoppers, plant bugs, and stem cankers; deer resistant tree; needs pruning when young to develop a central leader; native to WI; Fabaceae family

'Draves' (STREET KEEPER®): hardy to zone 4a; 45' tall, 20' wide; narrow, strongly upright, tight pyramidal form; yellow fall color; generally fruitless, but occasionally produces a few pods

'Harve' (NORTHERN ACCLAIM®): hardy to zone 3b; 45' tall, 35' wide; symmetrical, upright, spreading form; bright yellow fall color; male cultivar; fruitless; developed at North Dakota State University

'Impcole' (IMPERIAL®): hardy to zone 4a; 35' tall, 35' wide; symmetrical, rounded, wide-spreading form with good branching; yellow fall color; generally fruitless, but occasionally produces a few pods; susceptible to leaf hoppers and plant bug

'JFS Morgenson1' (NORTHERN SENTINEL™): new cultivar; hardy to zone 4a; 45' tall, 25' wide; upright-vase shape to upright-oval form; yellow fall color; supposed to be more resistant to snow and ice damage, generally fruitless; developed from South Dakota

'PNI 2835' (SHADEMASTER®): hardy to zone 4a; 45' tall, 35' wide; vase-shaped to rounded, irregular form with ascending branches; yellow fall color; generally fruitless, but occasionally produces a few pods

'Skycole' (SKYLINE®): hardy to zone 4a; 45' tall, 35' wide; broadly pyramidal form with ascending branches and wider branch crotch angles; develops a strong, central leader better than any other cultivar; bright golden yellow fall color; male cultivar; fruitless

'Suncole' (SUNBURST®): hardy to zone 4a; irregular, oval form; 40' tall, 35' wide; the last 8" of the twig produces new, bright yellow leaves that fade to green; yellow fall color; male cultivar; fruitless; susceptible to leaf hoppers, plant bug, and Nectria canker

***Gymnocladus dioicus*: Kentucky coffeetree**; hardy to zone 4a; 50-70' tall, 40-50' wide; upright-oval to vase-shaped form becoming irregular and open with age; coarse texture in winter with sparse branching; long, lacy, blue-green leaves; yellow fall color; ashy-gray, scaly to furrowed bark resembling stiff icing on a cake; produces 4-7" long, thick, dark brown, persistent pods resembling a burnt taco or sausage; fruit produced on female trees only; plant male cultivars (see below) to avoid fruit; adaptable to most soils and pH; tolerant to heavy clay, compacted soil, drought, heat, urban conditions, periodic flooding and road salt; no pest problems; deer resistant tree; can be bareroot transplanted; native to WI; Fabaceae family

'Espresso': hardy to zone 4a; 50' tall, 35' wide; oval to vase-shaped form with upright branches; male cultivar; fruitless

'J.C. McDaniel' (PRAIRIE TITAN®): hardy to zone 4a; 60-70' tall, 40' wide; upright, spreading form; male cultivar; fruitless

'McKBranded' (DECAF®): hardy to zone 4a; 50' tall, 40' wide; upright, oval form; finer textured branches, twigs and leaflets compared to species; caramel colored new leaves turn green; male cultivar; fruitless

'Morton' (SKINNY LATTE™): hardy to zone 4a; 50' tall and only 18' wide; narrow, vase-shaped to columnar form; stiff, upright branches; male cultivar; fruitless

'True North': hardy to zone 4a; 50-70' tall, 35-40' wide; upright, vase-shaped form; male cultivar; fruitless

***Platanus ×acerifolia* 'Morton Circle': EXCLAMATION!® London planetree**; hardy to zone 5a; 55-60' tall, 35' wide; very uniform, upright-pyramidal form with a straight, central leader; fast grower; large, dark green leaves cast dense shade; no fall color; very showy, exfoliating bark in large, tan to creamy-green plates revealing olive inner bark; pendulous, 1", rounded ball-like fruit in clusters of 2-3; fruit is not a litter problem; adaptable to most soils and pH; tolerant to heavy clay, compacted, dry, poorly drained soil; drought, urban, heat and wet soil tolerant; intolerant to road salt and some sensitivity to air pollution; resistant to anthracnose, powdery mildew and frost crack compared to other cultivars of London planetree; can bareroot transplant; deer resistant tree; hybrid origin of American sycamore (*Platanus occidentalis*) and Oriental sycamore (*Platanus orientalis*); Platanaceae family

***Prunus maackii*: Amur chokecherry**; hardy to zone 3a; 30-40' tall, 25-35' wide; pyramidal when young becoming rounded with age; often sold as a multi-stemmed tree; early, yellow fall color; very showy, shiny, cinnamon-brown to coppery-yellow, semi-exfoliating bark; white flowers in 2-3" long, pendulous clusters in mid spring; small, black fruit in summer that is quickly eaten by birds; requires a cool, loamy, fertile, well-drained soil; intolerant to heavy clay, compacted, poorly drained or wet soil; pH adaptable; moderate salt tolerance; less susceptible to insects and diseases that can plague other cherries and plums; dig from field in spring only; native to Korea and Manchuria in China; Rosaceae family

***Quercus bicolor*: swamp white oak**; hardy to zone 4a; 50-60' tall and wide; pyramidal when young becoming rounded with broad spreading branches; large green leaves with whitish undersides; no fall color to yellow-brown; light brown acorn produced on 1-2" long stalks attracts wildlife; exfoliating, gray-brown bark on younger trees and stems; older bark has deep fissures; adaptable to most soils and pH; tolerant to heavy clay, poorly drained to wet soil; drought and urban tolerant; requires a slightly acidic to slightly alkaline pH soil; develops chlorosis in soil pH above 7.5; moderate salt tolerance; prune all oaks only during dormant season; can get oak wilt, anthracnose, two-lined chestnut borer and gypsy moth; can bareroot transplant; native to WI; Fagaceae family

'Bonnie and Mike' (BEACON®): hardy to zone 4a; 40' tall, only 15' wide; narrowly columnar form; upright branching; yellow fall color

'JFS-KW12' (AMERICAN DREAM®): hardy to zone 4a; 50' tall, 40' wide; broadly pyramidal form; vigorous grower; bright green, glossy leaves; yellowish fall color; good resistance to anthracnose and powdery mildew

***Quercus ×bimundorum*: hybrid oak**; cultivars hardy to zone 4; height, width and form varies with cultivar; dark green leaves; fall color varies with cultivar; brown acorn attracts wildlife; adaptable to well-drained soils and pH; drought, air pollution, urban and heat tolerant; moderate salt tolerance; easy to transplant; can get oak wilt, anthracnose; two-lined chestnut borer and gypsy moth; below cultivars are powdery mildew resistant; columnar forms are good alternatives to larger trees for smaller spaces; hybrid origin of English oak (*Quercus robur* or *Q. robur* 'Fastigiata') and native white oak (*Quercus alba*); Fagaceae family

'Crimschmidt' (CRIMSON SPIRE™): hardy to zone 4; 45' tall, 15' wide; columnar to tightly fastigate form; dark green to blue-green leaves; rusty-red fall color; holds onto older leaves in winter; powdery mildew resistant

'JFS-KW1QX' (STREETSPIRE®): hardy to zone 4; 45' tall, 14' wide; narrow, columnar form; dark green leaves; rusty-red fall color; does not hold on to old leaves in winter; stiff, short, upright branches; wider branch crotch angles; powdery mildew resistant

'JFS-KW2QX' (SKINNY GENES®): hardy to zone 4; 45' tall, 10' wide; columnar to tightly fastigate form; glossy, very dark green leaves; yellow to brown fall color; powdery mildew resistant

'Midwest' (PRAIRIE STATURE®): hardy to zone 3b(4a); 50' tall, 40' wide; broad, pyramidal form; dark green leaves; yellow-orange to reddish fall color; powdery mildew resistant

'Tabor' (FOREST KNIGHT®): hardy to zone 4; 50' tall, 40' wide; symmetrical, broadly oval form; glossy, dark green leaves; orange-red fall color; strong branching; powdery mildew resistant

***Quercus macrocarpa*: bur oak**; hardy to zone 3b; 60-70' tall, 60-80' wide; pyramidal when young, becoming broadly oval to irregular and open with age; large, dark green leaves; no fall color to pale yellow-brown; deeply furrowed, dark gray to dark brown bark; brown acorn with fringed cap edges attracts wildlife; adaptable to most soils and pH; tolerant to dry, heavy clay and wet soil, drought, road salt, heat and urban conditions; can get oak wilt, anthracnose, bur oak blight; two-lined chestnut borer and gypsy moth; difficult to transplant; do not bareroot transplant; native to WI; Fagaceae family

'JFS-KW14' (COBBLESTONE®): hardy to zone 3b; 55' tall, 45' wide; broadly oval form; dark green leaves; very corky bark when young; powdery mildew and anthracnose resistant

'JFS-KW3' (URBAN PINNACLE®): hardy to zone 3b; 55' tall, only 25' wide; narrow pyramidal to oval form; strong, central leader; dark green, glossy leaves; very small acorns; powdery mildew and anthracnose resistant

***Quercus × macdenielli* 'Clemon's': HERITAGE® oak**; hardy to zone 4; 50-60' tall, 40-50' wide; broadly pyramidal becoming oval form; glossy, dark green leaves; no fall color to yellowish; brown acorn attracts wildlife; adaptable to most soils and pH; heavy clay, drought, heat and urban tolerant; moderate salt tolerance; can get oak wilt, anthracnose, two-lined chestnut borer and gypsy moth; powdery mildew resistant; do not bareroot transplant; hybrid cross of English oak (*Quercus robur*) and native bur oak (*Q. macrocarpa*); Fagaceae family

***Quercus montana* (formerly *Q. prinus*): chestnut oak, rock oak**; hardy to zone 4b; 50-60' tall, 40' wide; pyramidal when young becoming rounded with age; leaf similar to chinkapin oak, but slightly larger and wider; orange-yellow to reddish-brown fall color; deeply furrowed bark; large acorn attracts wildlife; adaptable to most, well-drained soils and pH, including dry, rocky soil; drought, heat and urban tolerant; moderate salt tolerance; can get oak wilt, anthracnose, two-lined chestnut borer and gypsy moth; do not bareroot transplant; native to eastern U.S.; Fagaceae family

***Quercus muehlenbergii*: chinkapin oak**; hardy to zone 4b; 50-60' tall and wide; narrow when young, becoming rounded and wide-spreading with age; narrower, coarsely toothed (but in white oak group), finer textured leaves; yellow to yellow-brown fall color; light ashy-gray, flaky bark; small, chestnut-brown to blackish acorns attract wildlife; adaptable to most, well-drained soils and pH; dry and clay soil tolerant; drought, urban and heat tolerant; moderate salt tolerance; can get oak wilt, anthracnose, two-lined chestnut borer and gypsy moth; do not bareroot transplant; native to WI; Fagaceae family

***Quercus × schuettei*: Schuette's oak**; hardy to zone 3b; 60-70' tall and wide; broad, rounded form; faster growing; glossy, dark green leaves; yellow to brown fall color; brown acorn attracts wildlife; adaptable to most soils and better tolerance to higher pH soil; easier to transplant; clay, drought, urban and heat tolerant; moderate salt tolerance; can get oak wilt, anthracnose, two-lined chestnut borer and gypsy moth; do not bareroot transplant; hybrid cross of native swamp white oak (*Q. bicolor*) and native bur oak (*Q. macrocarpa*), but is a natural hybrid native to WI; Fagaceae family

'Rick' (EPIC™): hardy to zone 3b; 50-60' tall and wide; broad, pyramidal form with ascending branches; dark green leaves; yellowish fall color; tree resembles a swamp white oak due to exfoliating bark on younger branches; tolerant to higher pH soils; Johnson's Nursery introduction

***Quercus × warei*: Ware's oak**; hardy to zone 4b; size and form vary with cultivars below; dark green leaves; yellow to brown fall color; brown acorn attracts wildlife; adaptable to most well-drained soils and pH; clay soil, drought, urban and heat tolerant; moderate salt tolerance; can get oak wilt, anthracnose, two-lined chestnut borer and gypsy moth; easier to transplant, but do not bareroot transplant; hybrid of columnar English oak (*Quercus robur* 'Fastigiata') and swamp white oak (*Quercus bicolor*); Fagaceae family

'Long' (REGAL PRINCE®): hardy to zone 4b; 40-45' tall, 15-18' wide; columnar to narrow-oval form; glossy, bright green leaves with silvery undersides; no fall color; powdery mildew resistant

'Nadler' (KINDRED SPIRIT®): hardy to zone 4b; 30-35' tall, only 6' wide; tight, columnar form; medium green leaves with silvery undersides; no fall color; powdery mildew resistant; good for tight spaces

***Taxodium distichum*: baldcypress**; hardy to zone 4b-5b (depends on seed source and most cultivars are not hardy here); 50-70' tall, 25-35' wide; pyramidal form with straight terminal leader and wide branch crotch angles; mint green, finely textured, soft, feathery-looking leaves; rusty-brown to orange-brown fall color; showy, reddish-brown to grayish, fibrous, shreddy bark; does not form cypress "knees" in urban soils unless very wet; adaptable to most soils; prefers slightly acidic soil, can get chlorotic in high pH soils; easy to transplant; drought, heat, urban, road salt and wet, clay soil tolerant; some difficulties to no problems with bareroot transplant; deer resistant tree; native to southeastern and southcentral U.S.; Cupressaceae family (formerly in Taxodiaceae family)

'Mickelson' (SHAWNEE BRAVE™): hardy to zone 5b; 55' tall, 20' wide; narrowly pyramidal form; narrower and more upright than the species; burnt orange fall color

***Tilia cordata*: littleleaf linden**; hardy to zone 3b; 50-70' tall, 35-50' wide; pyramidal when young becoming oval to round with age; small leaves turn yellow to yellowish-green in fall; showy, pale yellow, very fragrant, late spring to early summer flowers in pendulous clusters that attracts bees; tiny, rounded fruit; requires a deep, rich, fertile, loamy to clay, but well-drained soil; intolerant to compacted, dry, poorly drained or wet soil; pH adaptable; intolerant to road salt, wet soil or extended drought stress; more tolerant to air pollution and urban conditions; very susceptible to Japanese beetles, linden borer, gypsy moth, sun scald on trunk, basal stem rot and girdling roots due to deep planting of root flare, can get Verticillium wilt and anthracnose; prone to included bark formation due to narrow, branch crotch angles; easy to transplant; can bareroot transplant; sensitive to juglone; native to Europe; Malvaceae family (formerly Tiliaceae family)

'Bailey' (SHAMROCK®): hardy to zone 3b; 40-50' tall, 30' wide; pyramidal, symmetrical form; dark green; larger leaves; has a more open canopy and stouter branches; uniform branching; fast grower;

'Chancole' (CHANCELLOR®): hardy to zone 3b; 35-40' tall, 30-35' wide; uniform, narrow, pyramidal, compact form; better branching with wider branch crotch angles and superior tree form compared to GREENSPIRE® linden; fast grower

'Corzam' (CORINTHIAN®): hardy to zone 3b; 45' tall, only 15-20' wide; compact, narrow, pyramidal form, dense branching; prone to narrow, branch crotches; smaller, thicker and glossier, dark green leaves

'Halka' (SUMMER SPRITE®): hardy to zone 3b; only 15-20' tall, 15' wide; semi-dwarf form, dense, pyramidal to rounded; slow grower; yellow fall color

'PNI 6025' (GREENSPIRE®): hardy to zone 3b; 40-50' tall, 30-35' wide; broad, pyramidal, symmetrical form when young becoming rounded with age; straight terminal leader; uniformly spaced branches, but has serious problems with narrow, branch crotch angles and included bark formation; dark green leaves; yellow fall color

***Tilia x euchlora*: Crimean linden**; hardy to zone 4; 40-50' tall, 30-35' wide; broadly pyramidal to looser, oval form; very glossy, bright green leaves; yellow fall color; darker gray, fissured bark; showy, pale yellow, very fragrant, late spring to early summer flowers in pendulous clusters that attract bees; tiny, rounded fruit; requires a deep, rich, fertile, loamy to clay, but well-drained soil; intolerant to compacted, dry, poorly drained or wet soil; pH adaptable; intolerant to road salt, wet soil or extended drought stress; more tolerant to air pollution and urban conditions; very susceptible to Japanese beetles, linden borer, gypsy moth, sun scald on trunk, basal stem rot and girdling roots due to deep planting of root flare, can get Verticillium wilt and anthracnose; prone to included bark formation due to narrow, branch crotch angles; easy to transplant; can bareroot transplant; sensitive to juglone; hybrid of *T. cordata* and *T. dasystyla*; Malvaceae family (formerly Tiliaceae family)

***Tilia x flavescens* 'Glenleven': 'Glenleven' linden**; hardy to zone 3b; 50-60' tall, 35' wide; broad-pyramidal, symmetrical, more open form with a straight, central leader and better branch structure than other lindens; fast grower; larger leaves than littleleaf linden; yellowish fall color; showy, pale yellow, very fragrant, late spring to early summer flowers in pendulous clusters that attracts bees; tiny, rounded fruit; requires a deep, rich, fertile, loamy to clay, but well-drained soil; intolerant to compacted, dry, poorly drained or wet soil; pH adaptable; intolerant to road salt, wet soil or extended drought stress; more tolerant to air pollution and urban conditions; very susceptible to Japanese beetles, linden borer, gypsy moth, sun scald on trunk, basal stem rot and girdling roots due to deep planting of root flare, can get Verticillium wilt and anthracnose; prone to included bark formation due to narrow, branch crotch

angles; easy to transplant; can bareroot transplant; sensitive to juglone; hybrid of *T. americana* and *T. cordata*; Malvaceae family (formerly Tiliaceae family)

***Tilia* 'Harvest Gold': 'Harvest Gold' linden**; hardy to zone 3b; 40' tall; 30' wide; pyramidal form when young, broader with age; dark green, glossy, somewhat deeply cut to lobed leaves; bright golden-yellow fall color (best of the lindens); reddish-brown stems in winter on new growth; exfoliating bark atypical of lindens; showy, pale yellow, very fragrant, late spring to early summer flowers in pendulous clusters that attracts bees; tiny, rounded fruit; requires a deep, rich, fertile, loamy to clay, but well-drained soil; intolerant to compacted, dry, poorly drained or wet soil; pH adaptable; intolerant to road salt, wet soil or extended drought stress; more tolerant to air pollution and urban conditions; susceptible to Japanese beetles, linden borer, gypsy moth, but less susceptible to sun scald on trunk; can get basal stem rot and girdling roots due to deep planting of root flare; can get Verticillium wilt and anthracnose; prone to included bark formation due to narrow, branch crotch angles; easy to transplant; sensitive to juglone; hybrid of *T. cordata* x *T. mongolica*; Malvaceae family (formerly Tiliaceae family)

***Tilia* 'Redmond': 'Redmond' linden**; hardy to zone 3b; 40-50' tall, 30-35' wide; pyramidal to oval form with upright branches; has better branch structure than other lindens; can sucker at tree base; moderate to fast grower; yellow to yellow-green fall color; showy, pale yellow, very fragrant, late spring to early summer flowers in pendulous clusters that attracts bees; tiny, rounded fruit; requires a deep, rich, fertile, loamy to clay, but well-drained soil; intolerant to compacted, dry, poorly drained or wet soil; pH adaptable; intolerant to road salt, wet soil or extended drought stress; more tolerant to air pollution and urban conditions; very susceptible to Japanese beetles, linden borer, gypsy moth, sun scald on trunk, basal stem rot and girdling roots due to deep planting of root flare, can get Verticillium wilt and anthracnose; prone to included bark formation due to narrow, branch crotch angles; easy to transplant; can bareroot transplant; sensitive to juglone; hybrid of *T. americana* and *T. x euchlora*; Malvaceae family (formerly Tiliaceae family)

***Tilia tomentosa*: silver linden**; hardy to zone 4b; 50-60' tall, 40-50' wide; broad-pyramidal form becoming upright-oval with age; dark green leaves with silvery-white underneath that is apparent when the wind blows; yellowish fall color; showy, pale yellow, very fragrant, late spring to early summer flowers in pendulous clusters that attracts bees; tiny, rounded fruit; requires a deep, rich, fertile, loamy to clay, but well-drained soil; intolerant to compacted, poorly drained or wet soil; pH adaptable; intolerant to road salt and wet soil; more tolerant to heat, drought, air pollution and urban conditions; linden borer, gypsy moth, sun scald on trunk, basal stem rot and girdling roots due to deep planting of root flare, can get Verticillium wilt and anthracnose; less susceptible to Japanese beetles due to tiny hairs on backside of leaf; notorious for its included bark formation due to narrow, branch crotch angles, so will need pruning training; easy to transplant, but do not bareroot transplant; sensitive to juglone; native to southeastern Europe and western Asia; Malvaceae family (formerly Tiliaceae family)

'PNI 6051' (GREEN MOUNTAIN®): hardy to zone 4b; 45-50' tall, 35' wide; broad, pyramidal form to oval; fast grower; dark green leaves with silvery-white undersides; yellow fall color

'Silver Lining': hardy to zone 5; 40-50' tall, 30' wide; upright, pyramidal form; dark green leaves with silvery-white undersides; yellow fall color

'Sterling': hardy to zone 4b; 45' tall, 35' wide; symmetrical, broad, pyramidal form; dark green leaves with silvery-white undersides; yellow fall color

***Ulmus americana*: American elm**; select only Dutch elm disease (DED) tolerant elms; hardy to zone 3a-4b (depends on cultivar); 70-80' tall, 60-70' wide; beautiful, vase-shaped form with pendulous branches; dark to medium green leaves; yellow fall color; adaptable to most soils and pH; heavy clay, compacted, poorly drained, wet soil tolerant; drought, urban, air pollution and road salt tolerant; easy to transplant; can bareroot transplant in spring only; susceptible to many insects and diseases, including Dutch elm disease (DED) and phloem necrosis, but below cultivars are better; requires pruning when young to develop good branch structure; native to WI; Ulmaceae family

'Jefferson': hardy to zone 4a; 70' tall, 50' wide; upright, vase-shaped form with arching limbs; dark green leaves; DED tolerant; U.S. National Arboretum introduction

'JFS-Prince II' (COLONIAL SPIRIT®): hardy to zone 4a; 65' tall, 50' wide; symmetrical, vase-shaped form with arching limbs; dark green leaves; DED tolerant

'Lewis and Clark' (PRAIRIE EXPEDITION®): hardy to zone 3a; 55' tall, 60' wide; broad, rounded to spreading vase-shaped form; faster grower; DED tolerant; from trees growing in Fargo, ND
'New Harmony': hardy to zone 4a; 70' tall, 65' wide; vase-shaped form with arching branches; medium green leaves; vigorous grower; DED tolerant; U.S. National Arboretum introduction
'Princeton': hardy to zone 4a; 65' tall, 50' wide; upright, vase-shaped form; dark green, leathery leaves; more resistant to elm leaf beetle; DED tolerant; needs significant structural pruning for first 15 years of life to avoid branch failure from winter winds and ice storms
'St. Croix': hardy to zone 3b; 60-75' tall, 70-90' wide; broad, vase-shaped form with an open, spreading canopy; dark green leaves; DED tolerant; from MN
'Valley Forge': hardy to zone 4a; 70' tall and wide; broad, vase-shaped form with arching branches; somewhat of a wild looking form and branching; needs training to develop good form; vigorous grower; medium green leaves; DED tolerant; needs significant structural pruning for first 15 years of life to avoid branch failure from winter winds and ice storms; U.S. National Arboretum introduction

***Ulmus davidiana* 'JFS-KW2UD': GREENSTONE™ David elm**; hardy to zone 4a; 60' tall, 40' wide; upright, vase-shaped form; strong branching with wide branch crotch angles; medium green leaves; yellow fall color; adaptable to most soils and pH; drought, urban, air pollution tolerant; moderate salt tolerance; easy to transplant; can bareroot transplant in spring only; DED and phloem necrosis tolerant; resistant to elm leaf beetle and elm leaf miner; native to China, Korea and Siberia; Ulmaceae family

var. *japonica* 'Discovery': hardy to zone 4a; 35-40' tall and wide; upright, compact, vase-shaped form; glossy, dark green leaves; yellow fall color; DED and phloem necrosis tolerant; resistant to elm leaf beetles and most other leaf feeding insects

var. *japonica* 'Prospector': (formerly known as *Ulmus wilsoniana*); hardy to zone 4b; 40' tall, 30' wide; dense, broad, vase-shaped form with slightly pendulous branches; glossy, dark green leaves; yellow fall color; faster growing; DED and phloem necrosis tolerant; resistant to elm leaf beetle; native to China, Korea, Siberia and Japan; U.S. National Arboretum introduction

***Ulmus* hybrids: hybrid elms**; hardiness depends on hybrid cultivar; size and form varies with cultivar; fall color varies; adaptable to most well-drained soils and pH; heavy clay, drought, urban, heat and air pollution tolerant; moderate salt tolerance; below hybrid cultivars are Dutch elm disease (DED) and phloem necrosis tolerant; resistant to moderately resistant to elm leaf beetles; can bareroot transplant in spring only except for 'Frontier'; hybrid elms of several Asian and European elms, not American elm; some require pruning when young to develop a central leader; Ulmaceae family

'Frontier': hardy to zone 5; 35-40' tall, 25-30' wide; vase-shaped to broadly oval form; slower grower; glossy, dark green leaves; showy, late, burgundy fall color; exfoliating bark when older; barerooting can be difficult, but has been done successfully; hybrid of *Ulmus carpinifolia* (now *U. minor*) and *U. parvifolia*; U.S. National Arboretum introduction

'Morton' (ACCOLADE®): hardy to zone 4a; 60-70' tall, 60' wide; vase-shaped form with arching branches; fast grower; glossy, dark green leaves; yellow fall color; hybrid of *Ulmus japonica* (now *U. davidiana* var. *japonica*) and *U. wilsoniana* (now *U. davidiana* var. *japonica*); can bareroot transplant; Morton Arboretum introduction

'Morton Glossy' (TRIUMPH™): hardy to zone 4a; 55' tall, 45' wide; upright oval to vase-shaped form; symmetrical habit; fast growing; very glossy, dark green leaves; yellowish fall color; very drought tolerant; hybrid of 'Morton Plainsman' (VANGUARD™) and 'Morton' (ACCOLADE®) elms; Morton Arboretum introduction

'New Horizon': hardy to zone 4a; 50-60' tall, 40' wide; upright to oval with wide branch crotch angles; faster growing; dark green leaves; yellowish fall color; hybrid of *Ulmus japonica* (now *U. davidiana* var. *japonica*) and *U. pumila*; UW-Madison introduction

'Patriot': hardy to zone 4b; 50' tall, 35-40' wide; stiffly upright branching; narrow, vase-shaped form; faster growing; dark green leaves; yellowish fall color; hybrid of *U. wilsoniana* (now *U. davidiana* var. *japonica*), *U. pumila*, *U. carpinifolia* (now *U. minor*) and *U. glabra*; U.S. National Arboretum introduction

Smaller, ornamental trees tolerant to moderately tolerant to urban conditions

***Acer triflorum*: three-flower maple**; hardy to zone 4a; 20-25' tall, 15-25' wide; upright to rounded, symmetrical form; lower branches droop downward; sold as a single trunk or multi-stemmed tree; slow grower; trifoliate leaves turn yellow to orange in fall; showy, light tan to ashy-brown, exfoliating bark with vertical, papery cracks on trunk; flowers are not showy and not significant; full sun to partial shade; prefers a fertile, loamy, moist, well-drained soil, but is more tolerant to soils and urban conditions than other, smaller maples; intolerant to wet and compacted soil and poor drainage; pH adaptable; intolerant to road salt; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; difficult to transplant; dig in spring only; native to Manchuria and Korea; Sapindaceae family (formerly Aceraceae family)

***Acer truncatum*: Shantung maple, purple-blow maple**; hardy to zone 4b (5a, depends on provenance); 20-30' tall and wide; broad-rounded, dense, symmetrical form; glossy, dark green, star-shaped leaves; variable late fall color from none to yellow-orange to purple; full sun only; adaptable to most soils and pH; needs good drainage; heat, drought, salt, air pollution and urban tolerant; intolerant to wet soil; susceptible to Verticillium wilt and Asian longhorn beetle as it is a maple; can bareroot transplant; native to northern China, Russia, Korea and Japan; Sapindaceae family (formerly Aceraceae family)

'WF-At1' (MAIN STREET®): hardy to zone 5a; 20-30' tall, 15-25' wide; uniform, rounded form; faster growing; dark green leaves; orange-red fall color; drought tolerant; Bailey Nursery introduction

***Cercis canadensis*: eastern redbud**; hardy to zone 4, only if cold hardy seed source (provenance) is grown, otherwise, trees grown from seed from southern U.S. trees will not be hardy in WI; most cultivars are not hardy except for a few below; 20-30' tall and wide; upright, spreading to vase-shaped form becoming flat-topped with age; low branches and often multi-stemmed tree; heart-shaped leaves turn yellow in fall; brownish-black bark with orange inner bark when older; very showy, reddish-purple, long lasting flowers in early spring; tolerates full sun to partial shade; performs better with some afternoon shade; adaptable to most soils and pH; drought tolerant, but intolerant to wet soils or road salt; susceptible to Verticillium wilt; dig from field in spring only; do not bareroot transplant; native to eastern U.S., but not WI; there are more cultivars available than the ones below, but they are not cold hardy to WI; Fabaceae family

Columbus Strain: hardy to zone 4b; same size, shape and flowers as species; seed propagated from trees planted in Columbus, WI; but not native in WI

Minnesota Strain: hardy to zone 4b; same size, shape and flowers as species; seed propagated from trees planted in Chaska, MN; but not native in MN

'Morton': JOY'S PRIDE™: hardy to zone 5a; 15' tall, 20' wide; oval to spreading form; bright lavender-pink flowers; seed propagated from trees growing in Lisle, IL; Morton Arboretum introduction

'Pink Trim': NORTHERN HERALD®: hardy to zone 4a; 20' tall and wide; rounded form; bright magenta-pink flowers borne in profusion all down the stems; darker green, leathery leaves; supposedly produces little fruit; seed propagated from trees growing in central South Dakota, but is not native in SD; North Dakota State University introduction

'UMN7101': HEART'S DESIRE™: hardy to zone 4b; 15-20' tall, 15-20' wide; spreading, rounded form; lavender-pink flowers; seed propagated from trees growing in Chaska, MN; but not native in MN

***Crataegus crus-galli* 'Inermis' (sometimes listed as var. *inermis*): thornless cockspur hawthorn**; hardy to zone 4a; 20-30' tall, 20-35' wide; wide-spreading, dense, flat-topped form; often multi-stemmed tree; low, horizontal branches; glossy, dark green leaves; showy bronzish-orange to reddish-purple fall color; species is covered in long, very sharp, 2-3" long thorns, but this cultivar is thornless; showy, white, flat-topped flower clusters in late spring; flowers do not smell good when up close; showy, deep red, ½" in diameter fruit in early to mid-fall that drops to the ground before winter; adaptable to most soils and pH, poor, dry, heavy clay soil tolerant; drought, urban, heat, pollution and salt tolerant; susceptible to cedar hawthorn rust on leaves and cedar quince rust on fruit, but is non-lethal; difficult to transplant; dig from field in spring only; do not bareroot transplant; deer resistant tree; native to eastern and central U.S., Canada, and Wisconsin; Rosaceae family

'Cruzam' (CRUSADER®): hardy to zone 4a; 15-20' tall, 15' wide; compact, rounded form with horizontal branching; leathery, dark green, glossy leaves; scarlet, purple to orange-bronze fall color; this cultivar produces no sharp thorns

'Inermis': hardy to zone 4a; 20-25' tall, 25' wide; rounded, spreading form with horizontal branching; thick, leathery, dark green, glossy leaves; orange to rusty-orange fall color; this cultivar produces no sharp thorns

***Crataegus phaenopyrum*: Washington hawthorn**; hardy to zone 4b; 20-30' tall, 20-25' wide; vase-shaped to broadly oval, dense form; often multi-stemmed tree; low, horizontal branches; dark green, semi-glossy, lobed leaves; showy, late, orange to reddish-purple fall color; species is covered in long, very sharp, 1-3" long thorns; showy, white, flat-topped flower clusters in late spring to early summer; slight bad odor of flowers when up close; very showy, glossy, bright orange-red to scarlet, ¼" in diameter fruit borne in clusters that are persistent from fall throughout winter; adaptable to most soils and pH; intolerant to wet soils; poor, dry, sandy soil tolerant; drought, urban and heat tolerant; moderate to low salt tolerance; susceptible to cedar hawthorn rust on leaves and cedar quince rust on fruit, but is non-lethal; difficult to transplant; dig from field in spring only; do not bareroot transplant; deer resistant tree; native to eastern U.S. and Canada; Rosaceae family

***Crataegus viridis* 'Winter King': 'Winter King' hawthorn**; hardy to zone 4b; 20-25' tall, 20-30' wide; vase-shaped to rounded, wide-spreading form; often multi-stemmed tree; low, horizontal branches; dark green, semi-glossy leaves; yellow to orangish fall color; this cultivar produces few, if any, 1½" long thorns; showy, silvery-gray bark becoming exfoliating with age revealing orange to brown inner bark; showy, white, flat-topped flower clusters in late spring; slight bad odor of flowers when up close; showy, bright orange-red, persistent, ½" diameter fruit borne in small clusters from fall to early winter; adaptable to most soils and pH; intolerant to wet soils; poor soil, drought, urban and heat tolerant; moderate to low salt tolerance; less susceptible to cedar hawthorn rust on leaves and cedar quince rust on fruit, but is non-lethal; difficult to transplant; dig from field in spring only; does not bareroot transplant, but some municipalities had success; deer resistant tree; native to eastern U.S.; Rosaceae family

***Maackia amurensis*: Amur maackia**; hardy to zone 3b; 20-30' tall and wide; vase-shaped to rounded form; upright branches; slow growing; silvery and fuzzy leaves in spring turn olive-green and smooth; no fall color; showy, coppery-green to brownish bark that develops curling strips that peel backwards with age; showy, dull white, slightly fragrant, upright flower clusters in summer; adaptable to most soils and pH, but grows best in loose soils; dry, infertile soil tolerant as roots fix atmospheric nitrogen; urban tolerant; moderate drought tolerance; intolerant to road salt; no pest problems; needs corrective pruning when young; easy to transplant; can bareroot transplant; native to Manchuria in northeast China; Fabaceae family

'JFS-Schichtel1' (MAACNIFICENT®): hardy to zone 3b; 30' tall, 20-22' wide; upright, dense, uniform, vase-shaped form; faster grower

'Starburst': hardy to zone 3b; 20-30' tall, 20-25' wide; upright, vase-shaped, dense form; faster grower

***Malus* spp: flowering crabapple**; hardy to zone 3b-5a (cultivar dependent); height, width, form, leaf color, flowers and fruit vary by species and cultivars; choose cultivars that have small, persistent fruit; adaptable to most, well-drained soils and pH except for very high soil pH; do not over fertilize with nitrogen or insect pests will increase; intolerant to wet soils; full sun only; drought and urban tolerant; moderate to low salt tolerance; susceptible to many insects and diseases including apple scab, frog-eye leaf spot, fireblight, cedar apple rust, powdery mildew and Japanese beetles; cultivars below are more resistant to foliar diseases, especially to apple scab; tree does require training pruning when young; remove root suckers each year, if any produced; sensitive to juglone; dig from field in spring only; can bareroot transplant; many species and hybrids are native from Asia, Europe and a couple from the U.S., but those have greater susceptibility to diseases; cultivars below are all hardy to zone 4 unless specified otherwise; Rosaceae family

White Flowers/Red Fruit: these flowering crabapples produce white flowers followed by bright red to dark red fruit

'Adirondack': 15-20' tall, 10-12' wide; narrow, upright to oval form; good for narrow spaces or a formal look; dark green leaves; dark, pinkish-red buds open to large, white flowers; persistent, bright red, ½" in diameter fruit

Malus baccata 'Jackii': hardy to zone 3; 30-35' tall, 20' wide; upright, rounded form; glossy, dark green leaves; fragrant, white flowers; persistent, purplish-red to maroon-red, ½" in diameter fruit borne on

long stems

'Guinzam' (GUINEVERE®): 6-8' tall, 12-15' wide; rounded form; dark green leaves with deep wine overtones; yellow to orange fall color; mauve buds open to white, fragrant flowers; persistent, bright red, 3/8" in diameter fruit

'Jarmin' (MARILEE®): 25' tall, 10' wide; narrow, upright form; ascending branches; pink flower buds open to large, double, white flowers with a hint of pink; mainly fruitless

'Jewelcole' (RED JEWEL®): 15-18' tall, 12' wide; upright, pyramidal to rounded form; dark green leaves; white flowers; very persistent, shiny, bright cherry-red, 1/2" in diameter fruit turning dark red when cold; fruit borne on long stems; some susceptibility to fireblight, especially if over fertilized with nitrogen

'JFS-KW214MX' (IVORY SPEAR™): 18' tall, 7' wide; narrow, tightly columnar form; dark green leaves; dark pink buds open to white flowers; bright cherry-red, 1/2" in diameter fruit

'Kinarzam' (KING ARTHUR®): 8-10' tall, 12' wide; upright, rounded form; dark green leaves; pink in bud opening to white flowers; bright red, 1/2" in diameter fruit; can sucker from base

'Lollizam' (LOLLIPOP®): 8-10' tall and wide; compact, rounded form; slow grower; bright green leaves; light pink buds open to fragrant, white flowers; red, 3/8" in diameter fruit

'Sutzam' (SUGAR TYME®): 15-20' tall, 15' wide; upright-oval to spreading form; dark green leaves; pale-pink flower buds open to fragrant, white flowers; persistent, red, 1/2" in diameter fruit

Malus sargentii 'Select A' (FIREBIRD®): 8' tall, 15' wide; rounded, spreading form; slow growing; reddish-pink buds open to white flowers; persistent, bright ruby-red, 3/8" in diameter fruit; lots of fruit are produced

Malus sargentii 'Tina': hardy to zone 5a; 5' tall, 8-10' wide; dwarf, rounded to low, spreading form, can be shrub-like or grafted on a standard to create a tree; slow grower; bright reddish-pink buds open to fragrant, white flowers; bright red, 1/4" in diameter fruit

Malus zumi var. calocarpa: hardy to zone 4b(5a); 15-20' tall, 20-25' wide; broad, rounded to spreading form; glossy, dark green leaves; deep-red flower buds open to fragrant, pinkish-white to white flowers; persistent, glossy, bright red, 3/8" in diameter fruit

White Flowers/Yellow to Orange Fruit: these flowering crabapples produce white flowers followed by yellow to orange fruit

'Excazam' (EXCALIBUR™): 10-12' tall, 8-10' wide; upright, dense form; light green, deeply lobed leaves; white flowers; light golden-yellow to gold-green, 1/4" in diameter fruit

'JFS-KW207' (SPARKLING SPRITE®): 12' tall and wide; compact, dense, rounded form; bright green leaves; pink buds open to white flowers; persistent, yellow to golden-orange, 1/4" in diameter fruit

'Lanzam' (LANCELOT®): 8-10' tall, 8' wide; compact, upright-oval, dense form; golden-yellow fall color; red buds open to white flowers; persistent, golden-yellow, 3/8" in diameter fruit

'Ormiston Roy': 20' tall, 25' wide; broad-rounded form; furrowed, orangish-brown bark; rose-red buds opening to white flowers; persistent, yellow, 1/2" in diameter fruit with a rosy blush; fruit turn orange-brown after a hard frost

Pink or reddish-purple flowers/Red to Purplish-Red Fruit: these flowering crabapples produce pink to reddish-purple flowers followed by bright red to dark purplish-red fruit

'Camzam' (CAMELOT®): 10' tall and wide; rounded form; dark green leaves with burgundy overcast; gold fall color; red buds open to fuchsia-pink to white flowers; persistent, burgundy, 3/8" in diameter fruit

'Cardinal': 16' tall, 20-22' wide; irregular, broadly spreading form; dark purplish-red, glossy leaves; bright, magenta-pink to pinkish-red flowers; deep red, 1/2" in diameter fruit, but not a lot of fruit produced

'JFS-KW213MX' (RASPBERRY SPEAR™): 20' tall, 8' wide; narrow, upright to columnar form; purple leaves turn bronze in late summer; dark pink buds open to bright magenta-pink flowers; persistent, maroon, 1/2" in diameter fruit ripen to bright red

'JFS-KW139MX' (RUBY DAYZE™): 22' tall, 16' wide; upright, tightly oval form; purple-red leaves become bronze in summer; orange-red fall color; bright magenta-pink flowers; persistent, deep red, 1/4" in diameter fruit

'Malusquest' (PINK SPARKLES®): 15' tall, 12' wide; compact, pyramidal form; glossy, dark green leaves; light pinkish-white flowers; very persistent, bright, cherry-red, 1/2" in diameter fruit; hybrid of 'Prairifire' and RED JEWEL® crabapples

'Orange Crush': 12-15' tall and wide; spreading form; bronze to purplish-green leaves; yellow fall color; dark pink to red flowers with a hint of orange; orange-red fruit

'Parrisi' (PINK PRINCESS®): hardy to zone 5a; 8' tall, 12' wide; low, spreading form; reddish-purple leaves in spring become bronzish-green in summer; rose-pink flowers; persistent, deep red, 1/4" in diameter fruit

'Prairifire': 15-20' tall and wide; upright, spreading to rounded form; slower growing; purple leaves become reddish-green in summer; apricot-orange fall color; purple, shiny bark; red buds open to bright, dark pinkish-red flowers; flowers open later than other crabapples; persistent, reddish-purple to dark red, 3/8-1/2" in diameter fruit; some apple scab, but not much

'Prairie Maid': 20' tall, 25' wide; spreading to rounded to spreading form; burgundy-red tinged leaves; orange to yellow fall color; fragrant, dark pink flowers; red, 1/4" in diameter fruit in fall only

'Purple Prince': 15-20' tall and wide; upright to rounded form; faster growing; dark purple leaves in spring turn bronzish-green in summer; purplish, cherry-like bark; bright carmine-red buds open to rose-red to deep pink flowers; persistent, maroon to dark purple with a bluish waxy coating, 3/8-1/2" in diameter fruit

Malus xadstringens 'Jefgreen' (EMERALD SPIRE®): hardy to zone 3a; 15-20' tall, 6-8' wide; columnar form; slow growing; silvery-green leaves; pink flowers with darker pink stripes; persistent, red, 1/2" in diameter fruit

Malus sargentii 'Candy mint': hardy to zone 5a; 10' tall, 15-18' wide; low, spreading, horizontal form; purple tinted leaves become bronzish-green in summer; deep carmine-pink buds open to fragrant, rose-pink flowers; deep reddish-purple, 1/3-1/2" in diameter fruit

Malus transitoria 'JFS-KW5' (ROYAL RAINDROPS®): 20' tall, 15' wide; upright, spreading form; deep purple, cutleaf leaves; orange-red fall color; bright, pinkish-red flowers; persistent, dark purplish-red to red, 1/4" in diameter fruit

Weeping Form: these cultivars have weeping, cascading form; flower and fruit color varies with cultivar
'Bailears' (RUBY TEARS™): 8-10' tall; 12-15' wide; graceful, weeping form; burgundy-green leaves; pink flowers; persistent, dark red, 3/8" in diameter fruit

'Coral Cascade': 15' tall, 15-20' wide; semi-weeping form; dark green leaves; coral-red flower buds open to light pinkish-white to white flowers; persistent, pinkish-coral to orange, 3/8-1/2" in diameter fruit

'Louisa': 10-15' tall and wide; graceful, broad weeping form; glossy, dark green leaves; rose-pink buds open to light pink flowers; yellow to amber, 3/8" in diameter fruit that fades to orangish-brown

'Manbeck Weeper' (ANNE E.®): 10-12' tall and wide; wide-spreading, horizontal weeper; glossy, green leaves; good yellow fall color; bright red flower buds open to white flowers; persistent, bright cherry-red, 3/8" in diameter fruit; difficult to find, but is one of the nicest weeping crabapples

'Molazam' (MOLTEN LAVA®): 15' tall, 12-15' wide; wide-spreading, horizontal, semi-weeping form; orange-brown bark; deep red buds open to white flowers; persistent, bright red, 1/2" in diameter fruit

'Royal Beauty': 10' tall, 8' wide; very narrow, weeping form becomes much broader with age; deep purple leaves turn bronzish-purple in summer; dark pink flowers, earlier than other cultivars; persistent, dark red, 1/2" in diameter fruit

***Prunus* 'Accolade': 'Accolade' cherry**; hardy to zone 4b; 20-25' tall and wide; upright, open, vase-shaped to spreading form; horizontal branches; dark green leaves; showy, golden to orange fall color; smooth, dark reddish-purple bark; dark pink buds open to semi-double, larger, light pink flowers in early spring; sterile so no fruit produced; moderate salt tolerance; dig from field in spring only; can bareroot transplant; hybrid of *P. sargentii* and *P. subhirtella*; Rosaceae family

***Prunus sargentii*: Sargent cherry**; hardy to zone 4; 25-35' tall, 20-30' wide; vase-shaped to oval form; tight branching; purplish to bronze new leaves in spring turn dark green soon afterwards; showy, bronze to orangish-red fall color; showy, reddish-gray to mahogany bark; showy, pink flowers in clusters in early spring; small, edible, red fruit turns black in summer that is quickly eaten by birds; requires a cool, loamy, fertile, well-drained soil; intolerant to heavy clay, compacted, poorly drained or wet soil; pH adaptable; salt tolerant; less susceptible to insects and diseases that can plague other cherries and plums; dig from field in spring only; can bareroot transplant; native to Japan; Rosaceae family

'Columnaris': hardy to zone 4; 35' tall, 15' wide; narrow, columnar to narrow, vase-shape form, orange to orange-red fall color

'Hokkaido Normandale' (SPRING WONDER™): hardy to zone 4; 20-25' tall, 20-24' wide; upright, vase-shaped form; purplish new leaves in spring; orange-red fall color; supposedly produces no fruit

'JFS-KW58' (PINK FLAIR®): hardy to zone 4; 25' tall, 15' wide; upright, narrow, vase-shape form; orange-red fall color; maroon, metallic-looking bark; flowers a week or two later than the species
'JFS-KW21PS' (PINK MYST™): hardy to zone 4; 30' tall, 15' wide; upright, narrow to upright oval form; orange to orange-red fall color; brighter, deeper pink flowers cover the branches

***Syringa pekinensis*: Pekin or Peking lilac**; hardy to zone 3b-4a; 25-30' tall, 20' wide; open, loose to rounded form; sold as either a single or multi-stemmed tree; moderate to fast grower; no fall color; showy, reddish-brown, shiny bark; showy, large, creamy-white, fragrant flowers in early summer that do not smell like typical lilacs; tends to flower heavily every other year; persistent, gold to tan turning brown, large fruit clusters through winter; adaptable to most soils and pH; intolerant to wet, poorly drained soil; moderate drought tolerance; salt and urban tolerant; resistant to powdery mildew, bacterial blight and Japanese beetles; susceptible to Verticillium wilt; easy to transplant; can bareroot transplant; sensitive to juglone; deer resistant tree; native to northern China; species has tendency to produce seedlings under tree and has potential to become invasive; Oleaceae family

'DTR 124' (SUMMER CHARM®): hardy to zone 4a; 20' tall, 15' wide; upright to rounded, spreading form; form is better than most cultivars; sold as a single-stemmed tree

'Morton' (CHINA SNOW®): hardy to zone 4a; 25-30' tall, 20' wide; upright, loose, open, spreading, wild-looking form; fast growing; very showy, coppery to cinnamon bark exfoliating in thin, curling strips; sold as a single-stemmed tree

'SunDak' (COPPER CURLS®): hardy to zone 3b; 20-25' tall, 20' wide; rounded to upright, spreading form; moderate grower; very showy, coppery-orange to cinnamon bark exfoliating in thin, curling strips; sold as a single-stemmed or multi-stemmed tree; very similar to CHINA SNOW® Peking lilac

'WFH2' (GREAT WALL™): hardy to zone 4a; 20' tall, 12-15' wide; upright, oval form; glossy, dark green leaves; golden yellow fall color; exfoliating, cherry-like bark; sold as a single-stemmed tree

'Zhang Zhimming' (BEIJING GOLD®): hardy to zone 4a; 25' tall, 20' wide; upright, rounded form, sold as either a single or multi-stemmed tree; yellow flowers instead of white

***Syringa reticulata*: Japanese tree lilac**; hardy to zone 3a; 20-25' tall, 20-30' wide; oval to rounded, spreading form with upright branches; sold as either a single or multi-stemmed tree; moderate growth rate; no fall color; showy, shiny, non-exfoliating, reddish-brown, cherry-like bark; showy, large, creamy-white fragrant flowers in early summer that do not smell like typical lilacs; tends to flower heavily every other year; persistent, gold to tan turning brown, large fruit clusters through winter; adaptable to most soils and pH; intolerant to wet, poorly drained soil; moderate drought tolerance; salt and urban tolerant; resistant to powdery mildew and Japanese beetles; susceptible to bacterial blight and Verticillium wilt; easy to transplant; can bareroot transplant; sensitive to juglone; deer resistant tree; native to Japan and Manchuria in China; species has tendency to produce seedlings under tree and has potential to become invasive; Oleaceae family

'Bailnce' (SNOWDANCE™): hardy to zone 3a; 18' tall, 20' wide; spreading, broad, rounded form; flowers heavily each year; supposed to be sterile or it may produce some fruit

'Elliott' (SNOWCAP™): hardy to zone 3a; 15-20' tall, 10-15' wide; compact, upright to pyramidal form with uniform branching; thick, dark green leaves; flowers heavily every other year

'Golden Eclipse': hardy to zone 3a; 18-24' tall, 10-14' wide; compact, upright form; new leaves in spring emerge green with a darker center; leaf margins gradually turn bright gold with the dark green center remaining; by midsummer, the gold margins fade to lighter green; flowers heavily every other year; good leaf resistance to sunburn compared to other variegated cultivars

'Ivory Silk': overused cultivar and should be used less to prevent another catastrophic pest from wiping out the population; hardy to zone 3a; 20-25' tall, 15' wide; upright spreading becoming oval to rounded form; flowers heavily every other year; susceptible to bacterial blight

'Summer Snow': hardy to zone 3a; 20' tall, 25' wide; compact, rounded form; slower growing than 'Ivory Silk'; dark green leaves; flowers heavily every other year?

'Summer Storm': hardy to zone 3a; 15-18' tall, 10-12' wide; broad, upright form; faster grower; flowers heavily every other year?

'Williamette' (IVORY PILLAR™): hardy to zone 3a; 20-25' tall, 10-15' wide; narrow-upright to pyramidal form; flowers heavily every other year

Digging season: Many trees and shrubs can be dug from the field during spring and either planted that spring, summer or fall. However, there are some tree species that should not be dug/harvested in the fall, thus should only be dug/harvested from the nursery field during spring. These trees include:

Freeman, red and silver, paperbark, three-flower, snake-bark, Korean and Japanese maples (*Acer* spp.), buckeyes and horsechestnuts (*Aesculus* spp.), all serviceberries (*Amelanchier* spp.), alders (*Alnus* spp.), pawpaw (*Asimina triloba*), all birches (*Betula* spp.), American and European hornbeams (*Carpinus* spp.), hickories (*Carya* spp.), chestnuts (*Castanea* spp.), northern catalpa (*Catalpa speciosa*), common hackberry (*Celtis occidentalis*), katsuratree (*Cercidiphyllum japonicum*), eastern redbud (*Cercis canadensis*), American yellowwood (*Cladrastis kentukea*), corneliancherry dogwood (*Cornus mas*), Turkish hazelnut (*Corylus colurna*), hawthorns (*Crataegus* spp.), common persimmon (*Diospyros virginiana*), beeches (*Fagus* spp.), Carolina silverbell (*Halesia tetraptera*), witchhazels (*Hamamelis* spp.), walnuts (*Juglans* spp.), all larches (*Larix* spp.), American sweet-gum (*Liquidambar styraciflua*), tuliptree (*Liriodendron tulipifera*), magnolias (*Magnolia* spp.), most flowering crabapples (*Malus* spp.), dawn redwood (*Metasequoia glyptostroboides*), black-gum (*Nyssa sylvatica*), ironwood (*Ostrya virginiana*), sourwood (*Oxydendrum arboretum*), Amur corktree (*Phellodendron amurense*), sycamore and planetrees (*Platanus* spp.), aspens and poplars (*Populus* spp.), cherries, plums, peaches and apricots (*Prunus* spp.), golden-larch (*Pseudolarix amabilis*), pears (*Pyrus* spp.), all oaks (*Quercus* spp.), willows (*Salix* spp.), sassafras (*Sassafras albidum*), mountainash (*Sorbus* spp.), baldcypress (*Taxodium distichum*), silver linden (*Tilia tomentosa*), and all elms (*Ulmus* spp.)

Bareroot tree planting: Trees are normally planted B&B (balled and burlapped), from containers or sold bareroot (without any packing material or soil). Bareroot transplanting has many benefits including lightweight, less shipping charges as load is much lighter and better ability to plant root (trunk) flare at proper height. However, there are species that should not be bareroot transplanted or have limited success when barerooted, regardless of time of year. These trees include:

Three-flower, snake-bark, paperbark and Japanese maples (*Acer* spp.), buckeyes and horsechestnuts (*Aesculus* spp.), serviceberries (*Amelanchier* spp.), American and European hornbeams (*Carpinus* spp.), hickories (*Carya* spp.), chestnuts (*Castanea* spp.), white fringetree (*Chionanthus virginicus*), Turkish hazelnut (*Corylus colurna*), although, some success with barerooting, all hawthorns (*Crataegus* spp.), but some success with barerooting 'Winter King' hawthorn (*Crataegus viridis* 'Winter King'), common persimmon (*Diospyros virginiana*), beeches (*Fagus* spp.), Carolina silverbell (*Halesia tetraptera*), witchhazels (*Hamamelis* spp.), walnuts (*Juglans* spp.), all larches (*Larix* spp.), American sweet-gum (*Liquidambar styraciflua*), tuliptree (*Liriodendron tulipifera*), all magnolias (*Magnolia* spp.), black-gum (*Nyssa sylvatica*), ironwood (*Ostrya virginiana*), golden-larch (*Pseudolarix amabilis*), oaks (*Quercus* spp. except swamp white, pin and northern red oak), sassafras (*Sassafras albidum*), baldcypress (*Taxodium distichum*), but some success with barerooting, silver linden (*Tilia tomentosa*), and lacebark (*Ulmus parvifolia*) and possibly 'Frontier' elm (*Ulmus* 'Frontier'), although some success with barerooting. Source: "Creating the Urban Forest: The Bare Root Method", 2009, by Dr. N. Bassuk, Urban Horticulture Institute, Cornell University, Ithaca, NY and Dr. Gary Johnson, University of Minnesota, personal communication.

Sweating: Most bare root oaks and other species are harvested from the nursery field in fall, bundled together, placed into cold, high humidity storage and held until early spring before shipping to other growers, landscapers and homeowners. Some species are notoriously slow to break bud in the landscape after planting in spring. To encourage faster budbreak in the landscape, some species require "sweating" before planting. Different species require different amount of time in the sweating process. If the sweating process is skipped for species requiring this technique, trees will be very late to leaf out in spring, resulting in a shorter growing season, reduced root growth and potential winter injury. Some trees may never leaf out and look or be dead.

Step 1. Wrap bundled trees of the same species together with twine.

Step 2. Place these bareroot trees horizontally either on directly onto bare ground, floor of a storage facility or garage or place onto large, plastic sheets in shade. Keep trees out of direct sunlight. Temperatures within the facility should be between 45-70°F.

Step 3. Water the roots of the plants only with a hose or dip the root system into a large tank of water. Wrap the roots only with wet packing material such as straw, shingle tow, burlap. Do not cover the stems with this wet material, just the roots.

Step 4. Cover the all roots and shoots with clear or opaque sheet of plastic and wrap edges underneath or use bricks to hold in place to keep the humidity high and temperatures warm inside the “tent”.

Step 5. After a couple of days, uncover and check to see if the buds have swollen. If bud scales start separating and the buds are quite plump, remove these trees from the plastic. These trees are then ready to be directly planted into the landscape or held in municipal gravel bed systems if the temperatures are consistently above freezing.

Step 6. If the buds are not swollen, continue the sweating process underneath the plastic and keep the wrapping material around the roots moist. Continue inspecting every couple of days until the trees are ready to be planted. The time required depends on the species requiring sweating. Larger caliper trees take longer to sweat up and could take one to two weeks of sweating before bud swell.

The key to success is **after** the sweating process. Delay planting of oaks and other barerooted trees until the weather is warmer and humid, typically in May for better success after the sweating process. This is especially critical for transplant success of oak liners. Bareroot oaks are best transplanted in spring, rather than fall. Selection of bareroot nursery stock with 2-2 ½” caliper or lower, reduces transplant shock and increases survival chances versus using larger caliper (4”+) bareroot trees. In the Upper Midwest, it is estimated that it takes an average of one year per 1” caliper sized tree to establish in the soil, regardless of if it is transplanted bareroot, from a container or balled and burlapped (B&B). For Wisconsin, a 2” caliper tree takes two or more years to establish in the landscape and is dependent on species, water availability and soil characteristics. Tree species that particularly benefit from the sweating process include:

Some maples (*Acer* spp.); Serviceberries (*Amelanchier* spp.), birches (*Betula* spp.), American and European hornbeams, musclewood (*Carpinus* spp.), hickories (*Carya* spp.), common hackberry (*Celtis occidentalis*), eastern redbud (*Cercis canadensis*), pagoda dogwood (*Cornus alternifolia*), hawthorns (*Crataegus* spp.), beeches (*Fagus* spp.), all ashes (*Fraxinus* spp.), thornless honeylocust (*Gleditsia triacanthos* f. *inermis*), flowering crabapples and apples (*Malus* spp.), mulberries (*Morus* spp.), black gum (*Nyssa sylvatica*), ironwood (*Ostrya virginiana*), Amur corktree (*Phellodendron amurense*), plums, cherries and apricots (*Prunus* spp.), pears (*Pyrus* spp.), oaks (*Quercus* spp.), black locust (*Robinia pseudoacacia*), weeping willow (*Salix* spp.) mountainash (*Sorbus* spp.), tree lilacs (*Syringa* spp.), baldcypress (*Taxodium distichum*), lindens (*Tilia* spp.) and elms (*Ulmus* spp.). Source: “Best Planting Practices Series: Category 1: Bareroot Nursery-Grown Trees and Shrubs” 2017, by Dr. Gary Johnson, University of Minnesota, St. Paul, MN.