



Recommended Alternatives to Ash Trees for Michigan's Lower Peninsula

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This guide gives suggestions for species that should be considered in situations where a homeowner, landscaper, or urban forester may have planted an ash in the past. General species characteristics, mature form and size, and other noteworthy characteristics are given; all are hardy to at least zone 5. Diversity of species is also important. Look around you, and plant a variety trees.

'Autumn blaze' Freeman maple *Acer x freemanii*

Height: 50-55 ft.

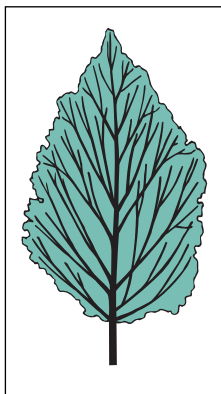
Spread: 30-40 ft.

Site preferences: Zone 4-7. Prefers moist soil but is drought tolerant. pH: adaptable. Fast growing.

Ornamental characteristics: Shape: oval-rounded. Foliage has excellent orange-red fall color.

Insect/disease factors: None serious.

Cultivars: Marmo, Sienna Glen



Trident maple *Acer buergeranum*

Height: 20-25 ft.

Spread: 20-35 ft.

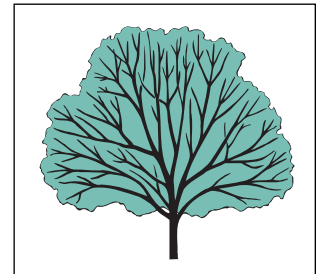
Site preferences: Zone 5b or 6a-8a. Prefers full sun. Adapted to urban conditions. Moderate salt tolerance. Tolerates moderate drought. pH: 5.0-7.0.

Ornamental characteristics:

Shape: round. Mottled bark, shedding with age; dense, dark green leaves turning orange to red in the fall.

Introduced from China.

Insect/disease factors: None serious.



Hedge maple *Acer campestre*

Height: 25-30 ft.

Spread: 25-30 ft.

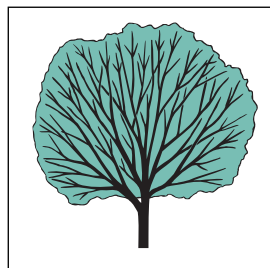
Site preferences: Zone 5a-8b.

Sun to partial shade. Tolerates drought. Moderate salt tolerance. pH: 5.0-8.2. Adapted to compaction, severe pruning.

Ornamental

characteristics: Shape: round. Excellent residential use under utility lines. Easily transplanted in spring or fall. Cultivars: 'Queen Elizabeth' (more upright, vigorous [zone 6b-7b]); 'Schichtel's Upright' (5b-8b). Introduced from Europe, Near East and Africa.

Insect/disease factors: Occasional problems with verticillium wilt.



Miyabe maple *Acer miyabei*

Height: 30-40 ft.

Spread: 20-30 ft.

Site preferences: Zone 4-7.

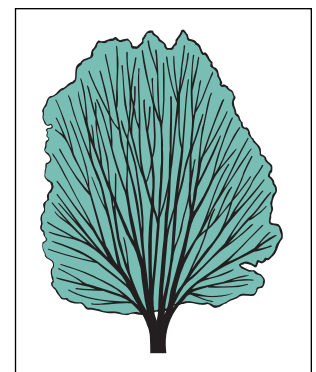
Moist, well-drained soil. pH: adaptable.

Ornamental characteristics:

Shape: rounded.

Insect/disease factors: None serious.

Cultivars: 'State Street' — fast growing, upright oval habit, dark green leaves with yellow fall color, corky bark.





Recommended Alternatives to Ash Trees for Michigan's Lower Peninsula

Norway maple *Acer platanoides*

Height: 40-50 ft.

Spread: 30-50 ft.

Site preferences: Zone 4-7.

Prefers moist soils and will tolerate clay (but not wet) soil. pH: very adaptable.

Ornamental characteristics:

Shape: rounded. Foliage is dark green with occasionally good yellow fall color.

Insect/disease factors:

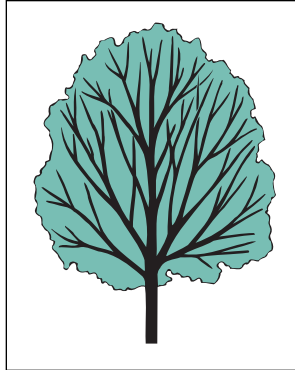
Verticillium wilt and anthracnose.

Cultivars: 'Crimson King' — reddish purple foliage;

'Columnare' — narrow oval habit (20-ft. spread);

'Summershade' — fast growing, heat resistant;

'Easy Street' — narrow oval.



Sugar maple *Acer saccharum*

Height: 60-80 ft.

Spread: 40-50 ft.

Site preferences: Zone 4-8.

Prefers moist, well-drained soil. pH: neutral to slightly acidic.

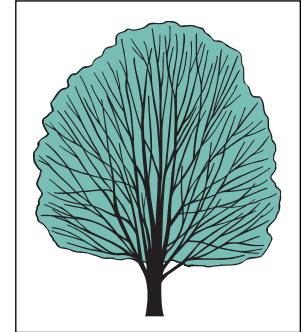
Ornamental characteristics:

Shape: oval to rounded.

Good fall color of yellow, orange or red.

Insects/disease factors: verticillium wilt, leaf scorch.

Cultivars: 'Crescendo' — dark green foliage with good orange-red fall color, heat and drought tolerant; 'Green Mountain' — thick, dark green leaves that resist leaf scorch, yellow fall color; 'Legacy' — thick and glossy dark green leaves, drought tolerant, yellow-orange fall color.



Red maple *Acer rubrum*

Height: 40-60 ft.

Site preferences: Zone 3b-9a.

Moist soils necessary; flood tolerance of specific cultivars is listed below. Salt sensitive. pH: 5.0-7.0 (chlorosis occurs at high pH).

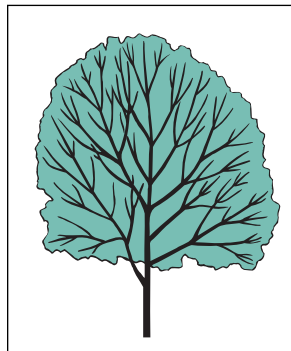
Ornamental characteristics:

Shape: round, upright. Good fall color.

Insect/disease factors:

Leafhopper and borers.

Cultivars: 'Autumn Flame' (early, low flood tolerance, persistent red fall color, zone 3b); 'Northwood' (low flood tolerance, good orange-red fall color, zone 3b); 'October Glory' (intermediate flood tolerance, excellent red fall color, zone 5a); 'Red Skin' (large, thick foliage, early reddish maroon fall color, rare, zone 4); 'Red Sunset'. Transplant in spring, high flood tolerance, specify "own-rooted" — graft incompatibility can be a problem. 'Redpointe' — pyramidal with dominant central leader.



Shantung maple *Acer truncatum*

Height: 25-30 ft.

Spread: 20-30 ft.

Site preferences: Zone 5a-7b (species is variable; hybrid cultivars, zone 5). Requires moist, well-drained site; tolerates moderate drought. Moderate salt tolerance.

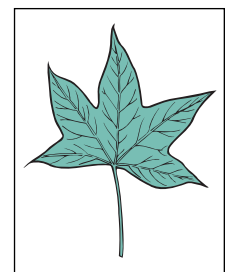
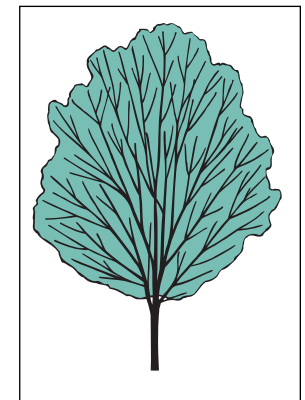
pH: 5.0-8.2. Resistant to leaf scorch.

Ornamental characteristics:

Shape: round. Dark green, glossy leaves with early fall color of yellow-orange to bright red.

Cultivars: Hybrids of *A. platanoides* are 'Norwegian Sunset' (upright round, orange-red to red fall color, more heat and drought tolerant than *A. platanoides*) and 'Pacific Sunset' (upright oval, finer branched and earlier red fall color than 'Norwegian Sunset').

Insect/disease factors: None serious.





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Horse chestnut *Aesculus hippocastanea*

Height: 50 ft. -75 ft.

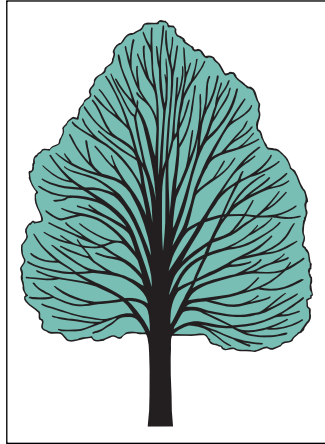
Spread: 40 ft. -70 ft.

Site preferences: Zone 4-8. Prefers moist, well-drained soils. pH: adaptable.

Ornamental characteristics: Shape: rounded. Other: showy white flowers in mid-May.

Insect/disease factors: Leaf scorch can occur under hot/dry conditions in late summer.

Cultivars: 'Baumani' more showy with longer lasting flowers and seedless.



Upright European hornbeam *Carpinus betulus* 'Fastigiata'

Height: 35 ft.

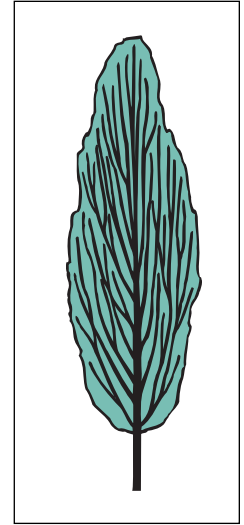
Spread: 25 ft.

Site preferences: Zone 5a-7a. Tolerates drought, heavy soil. Salt sensitive. pH: 5.0-8.2.

Ornamental characteristics: Shape: narrow when young, becoming oval; narrow branching angles.

Insect/disease factors: Canker, leaf spot and twig blight can occur if the tree is stressed.

Additional: Transplant in spring; somewhat slow to establish from bare root.



American hornbeam *Carpinus caroliniana*

Height: 20-30 ft.

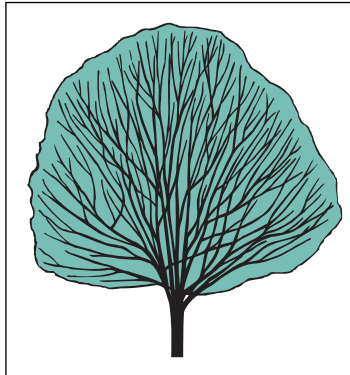
Spread: 20-30 ft.

Site preferences: Zone 3b-9a. Prefers moist soil but will tolerate some intermittent drought. pH: 5.0-8.2. Prefers shaded, moist soils.

Ornamental characteristics: Shape: round, spreading. "Muscled" bark, good orange-red fall color, clumps or single stem.

Insect/disease factors: Relatively pest and disease free, requires little maintenance, though damage by ice storms can be a problem. Cankers can occur with specimens of southern origin, so it is important to know the source of the tree.

Additional: Transplant in spring; somewhat slow to establish. Native to Michigan and eastern United States.



Hackberry *Celtis occidentalis*

Height: 40-60 ft.

Spread: 30 ft.

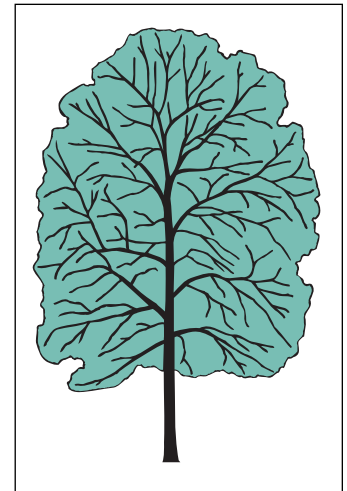
Site preferences: Zone 3b-8b. Tolerates drought. Salt sensitive. pH: 5.0-8.2. Tolerates light shade, wind, heat.

Ornamental characteristics: Shape: pyramidal when young; open, irregular when mature, with dark green, leathery leaves.

Insect/disease factors: Witch's broom and insect galls (aesthetic but not life-threatening problems).

Cultivars: 'Prairie Pride' (rapid, compact grower; thick, leathery foliage).

Additional: Transplant in spring; somewhat slow to establish.





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Katsura tree *Cercidiphyllum japonicum*

Height: 40 ft.

Spread: 40 ft.

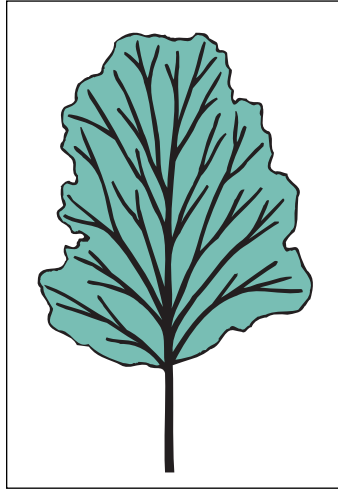
Site preferences: Zone 5a-9a. Requires evenly moist soils; not drought tolerant. pH: 5.0-8.2. Does not tolerate compaction or heavy soils; tolerates light shade. Protected site best.

Ornamental characteristics:

Shape: upright, pyramidal when young, becoming rounded with age.

New leaves are bright red when unfolding; good yellow fall color; dry leaves have caramel scent; clump or single stem.

Insect/disease factors: None serious.



Turkish filbert *Corylus colurna*

Height: 40-50 ft.

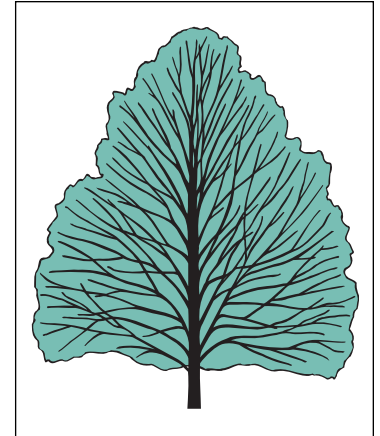
Spread: 20-30 ft.

Site preferences: Zone 4-7. Drought tolerant once established. pH: adaptable.

Ornamental characteristics: Shape: broad pyramidal, maintains formal shape. Other: attractive dark green foliage.

Insect/disease factors: None serious.

Additional: This is a low-maintenance but attractive species that is quite underused.



Yellowwood *Cladrastis kentukea*

Height: 30 ft.

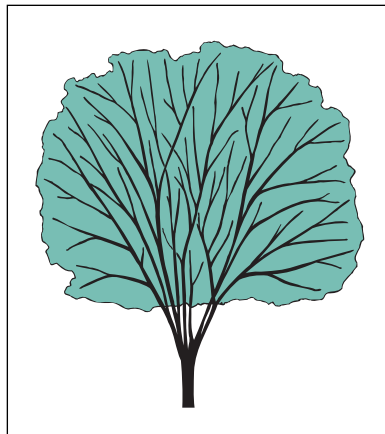
Spread: 40 ft.

Site preferences: Zone 4b-8a. Best in moist, well-drained soils; not drought tolerant. pH: 5.0-8.2.

Ornamental characteristics: Shape: round. Bright green foliage; showy, fragrant flowers in late spring.

Insect/disease factors: None.

Additional: Prune only in summer — profuse bleeding will occur at other times of the year. Specify single leader — can be weak-wooded with poor crotch angles that split out as the trees grow older. Transplant in spring.



Hardy rubber tree *Eucommia ulmoides*

Height: 40-60 ft.

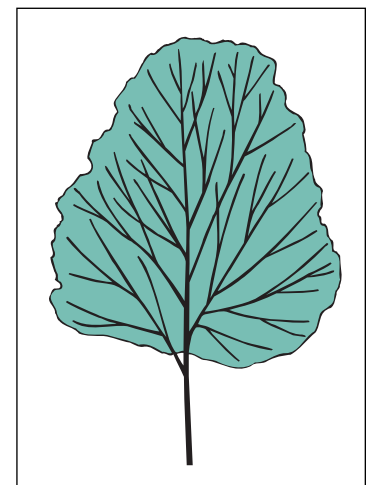
Spread: 45 ft.

Site preferences: Zone 5b-8.2. Tolerates drought; intolerant of poor drainage. pH: 5.0-8.2. Tolerates heat; needs full sun.

Ornamental characteristics: Shape: round, wide, spreading with ascending branches. Glossy green foliage.

Insect/disease factors: None.

Additional: Transplants easily in spring or fall.





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Ginkgo *Ginkgo biloba*

Height: 40-50 ft.

Spread: Variable, depending on cultivar.

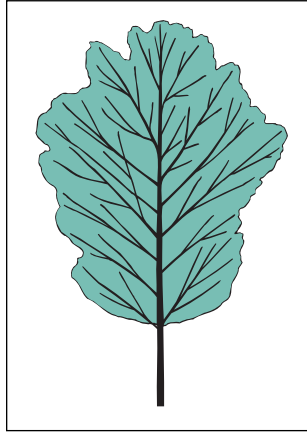
Site preferences: Zone 4b-8b. Tolerates drought. Moderate salt tolerance. pH: 5.0-8.2.

Ornamental characteristics: Shape: irregular when young, becoming pyramidal with age. Yellow fall color.

Cultivars: 'Autumn Gold' (symmetrical, broad, outstanding fall color); 'Lakeview'; and 'Princeton Sentry' (very narrow upright); 'Presidential Gold' (broadly oval, well branched).

Additional: Specify male trees because of noxious fruit smell (all cultivars are male). Transplant in spring or fall.

Insect/disease factors: None serious.



Kentucky coffee tree *Gymnocladus dioica*

Height: 60-75 ft.

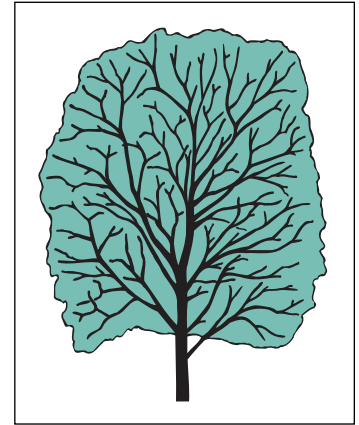
Spread: 40-50 ft.

Site preferences: Zone 3b-8. Drought tolerant after establishment. pH: adaptable.

Ornamental characteristics: Shape: oval crown with irregular branching. Foliage is dark green with compound leaves; can sometimes have a good yellow fall color.

Insect/disease factors: None serious.

Cultivars: 'Prairie Titan' — nice branching habit and blue-green summer foliage. 'Espresso' — seedless, good form.



Thornless honeylocust *Gleditsia triacanthos inermis*

Height: 40-100 ft.

Spread: 40 ft.

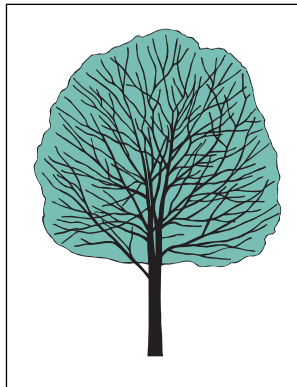
Site preferences: Zone 4b-9a. Tolerates wet and dry sites. High salt tolerance. pH: 5.0-8.2.

Ornamental characteristics: Shape: Open, spreading.

Insect/disease factors: Overplanting has encouraged severe insect problems in many areas (honeylocust plant bug, spider mite, borer, webworm).

Cultivars: 'Shademaster' (high, vase-shaped canopy, essentially fruitless); 'Skyline' (upright, pyramidal, strong central leader, good fall color); 'Northern Acclaim' (most cold hardy, good form).

Additional: Transplants easily in spring. 'Inermis' refers to the thornless selection.



Sweetgum *Liquidambar styraciflua*

Height: 70-100 ft.

Spread: 40-65 ft.

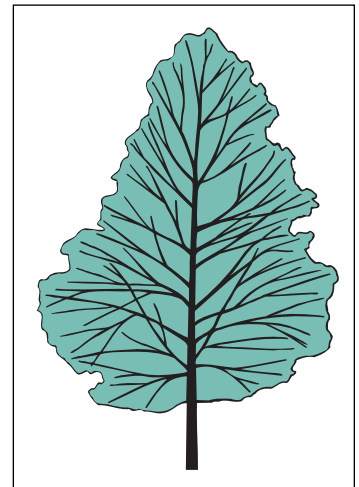
Site preferences: Zone 5b-9a. Tolerates intermittent flooding, moderate drought. pH: 5.0-7.5. Best on moist, sunny sites.

Ornamental characteristics: Shape: pyramidal when young, becoming round with age. Excellent fall color. Fruit litter may be objectionable.

Insect/disease factors: None serious.

Cultivars: 'Moraine' (most cold hardy, zone 4b, bright red fall color); 'Rotundaloba' (fruitless, not as hardy); 'Worplesdon' (orange-red fall color, broadly pyramidal to oval).

Additional: Northern seed source recommended. Transplant in spring. Iron chlorosis can occur.





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Tulip tree *Liriodendron tulipifera*

Height: 80-120 ft.

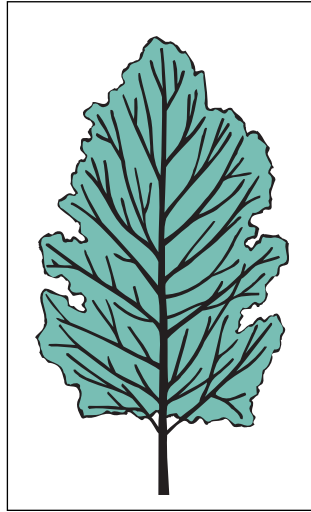
Spread: 35-50 ft.

Site preferences: Zone 5a-9a. Requires evenly moist soils but does not tolerate poor drainage. Needs adequate space. Salt sensitive. pH: 5.0-8.2.

Ornamental characteristics: Shape: broad pyramidal. Yellow fall color. Somewhat weak-wooded.

Insect/disease factors: Occasional problems with leaf scorch, canker, and verticillium wilt.

Additional: Transplant in spring. Northern seed source recommended.



Dawn redwood *Metasequoia glyptostroboides*

Height: 70-100 ft.

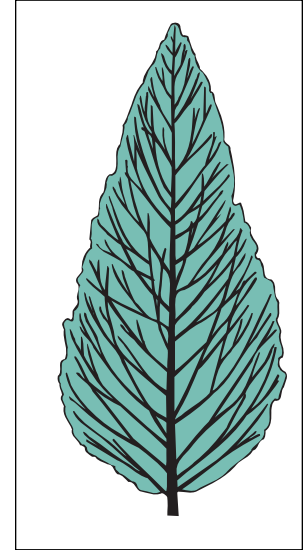
Spread: 25 ft.

Site preferences: Zone 5b-9a. Requires moist sites, will not tolerate dry sites. Salt sensitive. pH: 5.0-7.5.

Ornamental characteristics: Shape: pyramidal. Lower branches need to be removed for streetside use. Fast growing.

Insect/disease factors: Relatively trouble free, though Japanese beetle can be a nuisance.

Additional: Transplant in spring or fall.



Amur maackia *Maackia amurensis*

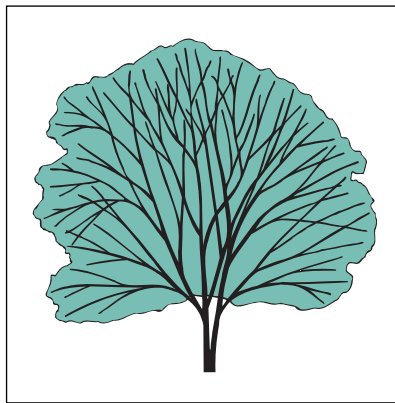
Height: 20-30 ft.

Spread: 30 ft.

Site preferences: Zone 4-7. Moist, well-drained soil. pH: adaptable.

Ornamental characteristics: Shape: rounded. White flowers in June; copper-brown, peeling, attractive bark.

Insect/disease factors: None serious.



Tupelo *Nyssa sylvatica*

Height: 35 ft.

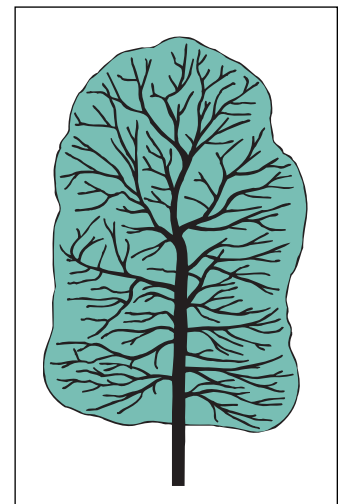
Spread: 20 ft.

Site preferences: Zone 5a-9a. Tolerates wet sites, intermittent drought. Relatively salt tolerant. pH: 5.5-7.0.

Ornamental characteristics: Shape: pyramidal. Bright red fall color.

Insect/disease factors: None.

Additional: Difficult to transplant — use small sizes, balled and burlapped only. Slow to recover from transplanting. Transplant in spring.





Recommended Alternatives to Ash Trees for Michigan's Lower Peninsula

American hophornbeam *Ostrya virginiana*

Height: 40 ft.

Spread: 25 ft.

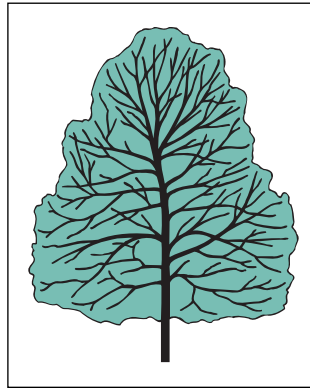
Site preferences: Zone 3b-9a. Prefers moist soil but will tolerate moderately dry soils once established. Very salt sensitive. pH: 5.0-8.2. Tolerates light shade.

Ornamental characteristics:

Shape: upright oval.
Foliage is dark green; fall color is yellow. Slow growing.

Insect/disease factors: None.

Additional: Slow to recover from transplanting. Transplant in spring.



London planetree *Platanus x acerifolia*

Height: 50 ft.

Spread: 40 ft.

Site preferences: Zone 5b-9a. Tolerates wet and intermittently flooded sites; drought tolerant. Salt tolerant. pH: 5.0-8.2.

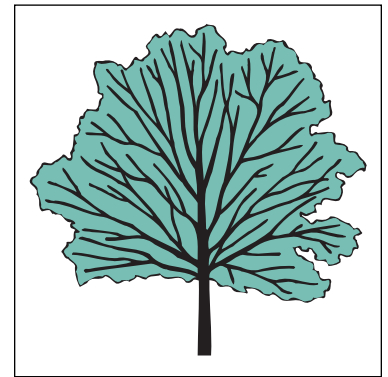
Ornamental characteristics:

Shape: pyramidal when young, becoming open, spreading with age. Medium green foliage, exfoliating bark.

Insect/disease factors: Overplanting has encouraged disease and insect problems in New York City. 'Liberty' resistant to anthracnose and powdery mildew; 'Bloodgood' moderately resistant. Cankerstain may be a problem.

Cultivars: 'Bloodgood' (maple-green foliage; tolerates severe pruning; rapid grower); 'Liberty'.

Additional: Transplant in spring or fall.



Amur corktree *Phellodendron amurense*

Height: 30-45 ft.

Spread: 40-50 ft.

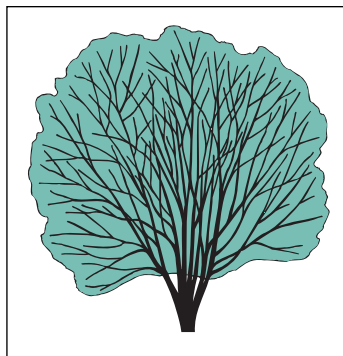
Site preferences: Zone 3b-7. Drought and pollution tolerant. pH: adaptable.

Ornamental characteristics:

Shape: broad, rounded. Yellow to bronze-yellow fall color. Ridged, corky bark in old age.

Insect/disease factors: None serious.

Cultivars: 'Eye Stopper'
'His Majesty'
'Macho'



Common chokecherry *Prunus virginiana*

Height: 20-30 ft.

Spread: 18-25 ft.

Site preferences: Zone 2-6. Tolerant of moist and dry sites. pH: adaptable.

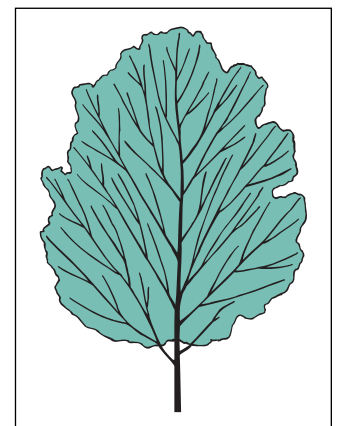
Ornamental characteristics:

Shape: rounded. White flowers in early May, red fruit that ripen to a dark purple.

Insect/disease factors:

Black knot.

Cultivars: 'Schubert' and 'Canada Red' — foliage emerges green but changes to a reddish purple for the remainder of the growing season; pyramidal habit.





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Callery pear *Pyrus calleryana*

Height: 50 ft.

Spread: 30 ft.

Site preferences:

Zone 5-8. Tolerant of moist and dry sites.

pH: adaptable.

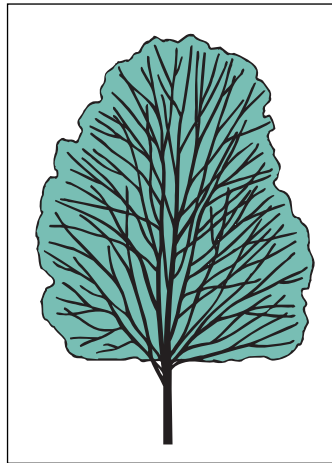
Ornamental

characteristics: Shape: formal rounded pyramidal.

Foliage is glossy dark green; good red to purplish fall color. White flowers in late April or early May.

Insect/disease factors: Fire blight.

Cultivars: 'Aristocrat' — wider shape, yellow to red fall color; 'Red spire' — pyramidal habit, yellow fall color; 'Chanticleer' — oval to narrow oval.



Swamp white oak *Quercus bicolor*

Height: 45 ft.

Spread: 45 ft.

Site preferences: Zone

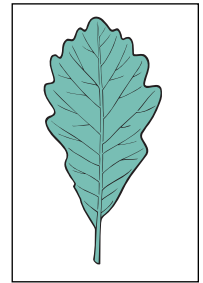
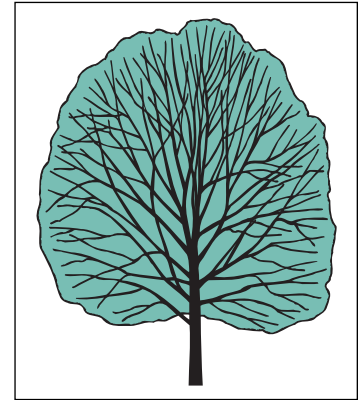
4a-8b. Tolerates temporary flooding, wet soils and somewhat dry soils. Salt sensitive. pH: 5.0-7.0.

Ornamental

characteristics: Shape: broad oval with round top. Foliage is green with wavy margins.

Insect/disease factors:

None serious. Variable susceptibility to iron chlorosis.



Sawtooth oak *Quercus acutissima*

Height: 40 ft.

Spread: 40 ft.

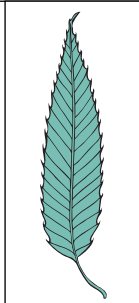
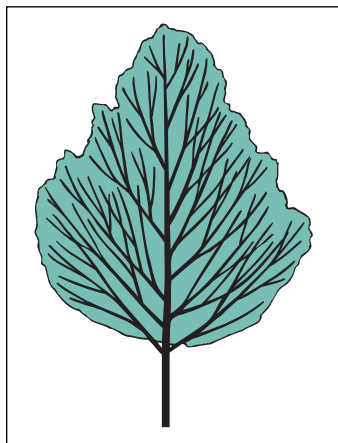
Site preferences: Zone

5b or 6a-9a. Tolerates moderately dry soils. Moderate salt tolerance. pH: 5.0-7.5. Good growth rate in moist sites.

Ornamental characteristics:

Shape: rounded. Foliage is dark green, glossy. Fall color is yellow.

Insect/disease factors: Reasonably pest free; preferred by orange-striped oak-worm.



Northern pin oak *Quercus ellipsoidalis*

Height: 50-60 ft.

Spread: 50 ft.

Site preferences:

Zone 4-6. Prefers moist, well-drained soil but tolerates wet and dry conditions. pH: neutral to slightly acidic.

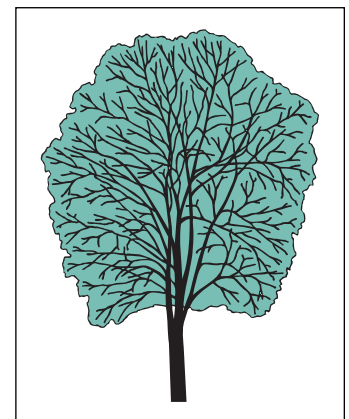
Ornamental

characteristics: Shape: pyramidal. Can have nice fall color.

Insect/disease factors:

Stem and leaf galls.

Additional: Does not have the chlorosis problems that occur in pin oak.





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Shingle oak *Quercus imbricaria*

Height: 50 ft.

Spread: 40 ft.

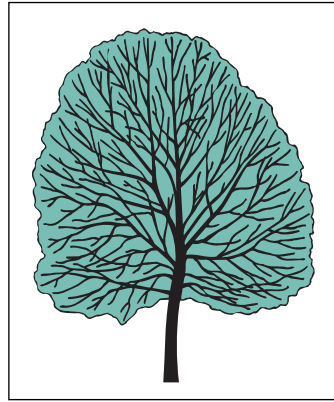
Site preferences:

Zone 5a-9a. Prefers moist soil but will tolerate intermittent drought.

pH: 5.0-7.5.

Ornamental

characteristics: Shape: broadly oval. Foliage is dark green, glossy. Fall color is yellowish to rusty red.



Insect/disease factors: Anthracnose, canker, powdery mildew, rust, wilt, galls, scales, borers, miners, etc., may be a problem.

Additional: Slow to recover from transplanting. Transplants well in spring.

Bur oak *Quercus macrocarpa*

Height: 55 ft.

Spread: 45 ft.

Site preferences: Zone 3a-9a. Tolerates drought and intermittent flooding.
pH: 5.0-8.2.

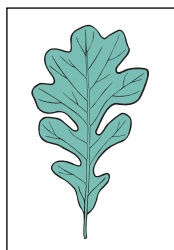
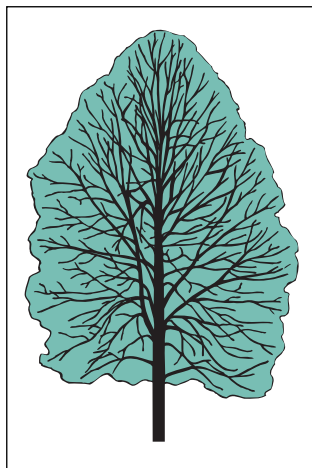
Ornamental characteristics:

Shape: broadly oval, irregular and open. Foliage is dark green. Fall color is yellow to yellow-brown. Corky bark.

Insect/disease factors:

Susceptible to anthracnose, intermediate preference by orange-striped oakworm but generally not seriously affected.

Additional: Slow growing, massive tree needs adequate space. Transplant small sizes in spring.



Chinkapin oak *Quercus muehlenbergii*

Height: 45 ft.

Spread: 45 ft.

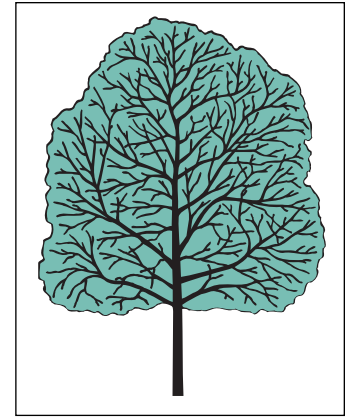
Site preferences: Zone

5a-8b. Tolerates moderate drought. pH: 5.0-8.2.

Extremely tolerant of alkaline soil.

Ornamental

characteristics: Shape: rounded, open. Foliage is lustrous dark green. Fall color is yellow to yellow-brown.



Insect/disease factors: None serious.

Additional: Transplant in spring.

Japanese pagodatree *Sophora japonica*

Height: 50-70 ft.

Spread: 40-70 ft.

Site preferences:

Zone 5b-9a. Tolerates drought. Salt tolerant. pH: 5.0-8.2.

Ornamental characteristics:

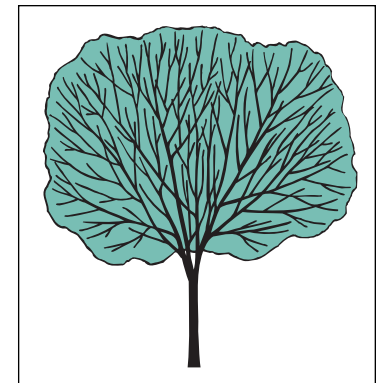
Shape: dense, round. Attractive cream-colored flowers in late July.

Insect/disease factors:

'Regent' resistant to leafhoppers, twig dieback and stem canker in colder zones.

Cultivars: 'Princeton Upright' (upright); 'Regent' (rapid growth, profuse flowering, resistant to leaf chewers).

Additional: Fixes own nitrogen. Transplant in spring or fall. Somewhat weak wooded.





Recommended Alternatives to Ash Trees for Michigan's Lower Peninsula

Linden or Basswood *Tilia americana*

Height: 35-50 ft.

Spread: 25-30 ft.

Site preferences: Zone 3a-8a. Requires moist, well-drained sites but will tolerate intermittent drought once established. Salt sensitive. pH: 6.5-8.2.

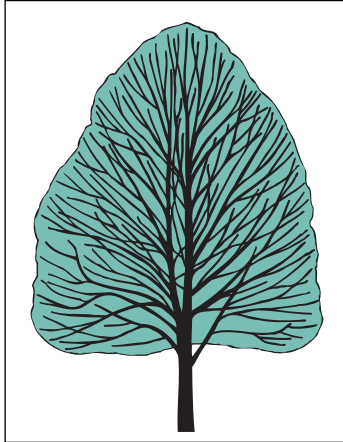
Ornamental characteristics: Shape: narrow to broad pyramidal, depending on cultivar.

Foliage is light green to dark green, depending on cultivar. Fragrant flowers in June.

Insect/disease factors: Very susceptible to Japanese beetles; mites, aphids, borers, leaf miners and scale may also be problematic.

Cultivars: 'Boulevard' (narrowly pyramidal, hardy to zone 3); Legend® (broadly pyramidal, zone 4, medium green); 'Redmond' (pyramidal, light green foliage).

Additional: Transplant in spring or fall.



Insects/disease factors: Japanese beetle, aphids, scab and linden mite.

Cultivars: 'Greenspire' — single leader and nice branching form; 'June Bride' — more formal habit and greater flowering; 'Harvest Gold' — very hardy, bright yellow fall color.

Silver linden *Tilia tomentosa*

Height: 50-70 ft.

Spread: 30-50 ft.

Site preferences:

Zone 3b-7. Prefers moist, well-drained soils but is somewhat drought and heat tolerant.

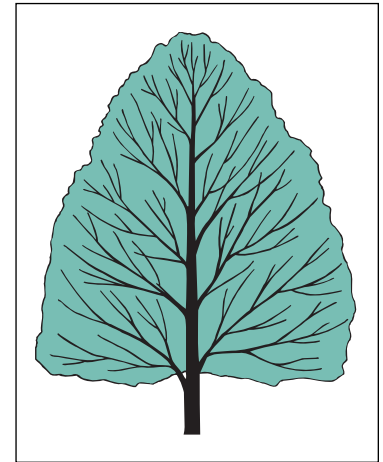
pH: adaptable.

Ornamental characteristics: Shape: upright oval. Glassy dark green leaves that are silvery underneath.

Yellowish white, fragrant flowers in early July.

Insect/disease factors: Same as little-leaf linden but less susceptible.

Cultivars: 'Green Mountain' — fast growing, better drought and heat tolerance; 'Sterling' — broad pyramidal habit, resistant to Japanese beetle.



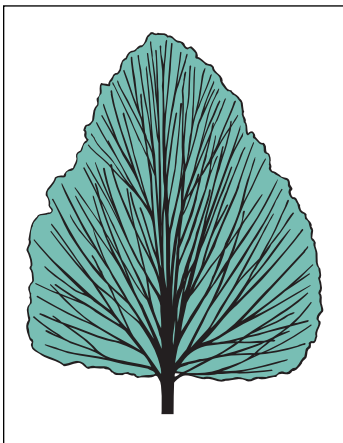
Little-leaf linden *Tilia cordata*

Height: 60-70 ft.

Spread: 40-50 ft.

Site preferences: Zone 3b-7. Prefers moist, well-drained soil. pH: adaptable. Pollution tolerant.

Ornamental characteristics: Shape: rounded and densely branched. Yellowish, fragrant flowers that emerge in late June.





Recommended Alternatives to Ash Trees for Michigan's Lower Peninsula

Elm hybrids *Ulmus spp.*

Height: 40-50 ft.

Spread: 30-50 ft.

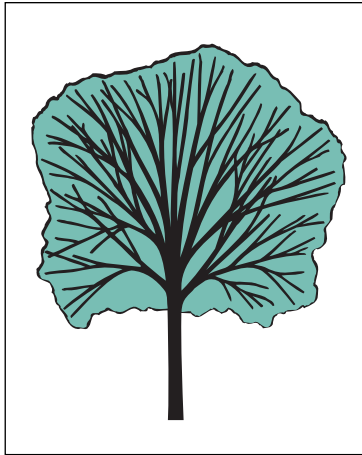
Site preferences: Zone varies. Tolerates intermittent flooding and drought once established. pH: 5.0-8.2.

Ornamental characteristics: Shape: upright vase.

Cultivars: Cultivars reportedly resistant to Dutch elm disease:

Hybrids: 'Accolade'
'Commendation'
'Frontier'
'Homestead'
'New Horizon'
'Triumph'

American: 'Valley Forge'
'Princeton'
'Jefferson'



Japanese zelkova *Zelkova serrata*

Height: 50-80 ft.

Spread: 40-50 ft.

Site preferences:

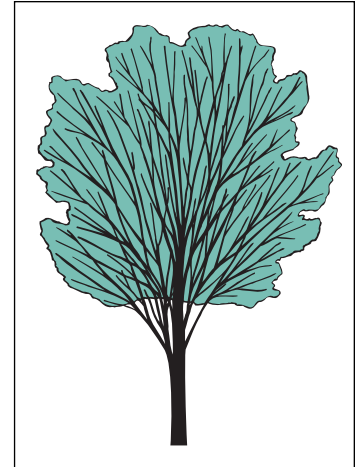
Zone 5. Prefers moist, well-drained soil but is drought tolerant. pH: adaptable.

Ornamental characteristics: Shape: vase-shaped. Foliage has rusty orange fall color. Flaky, attractive bark.

Insect/disease factors:

None serious.

Cultivars: 'Green Vase' — fast growing, nice branching habit, good fall color.

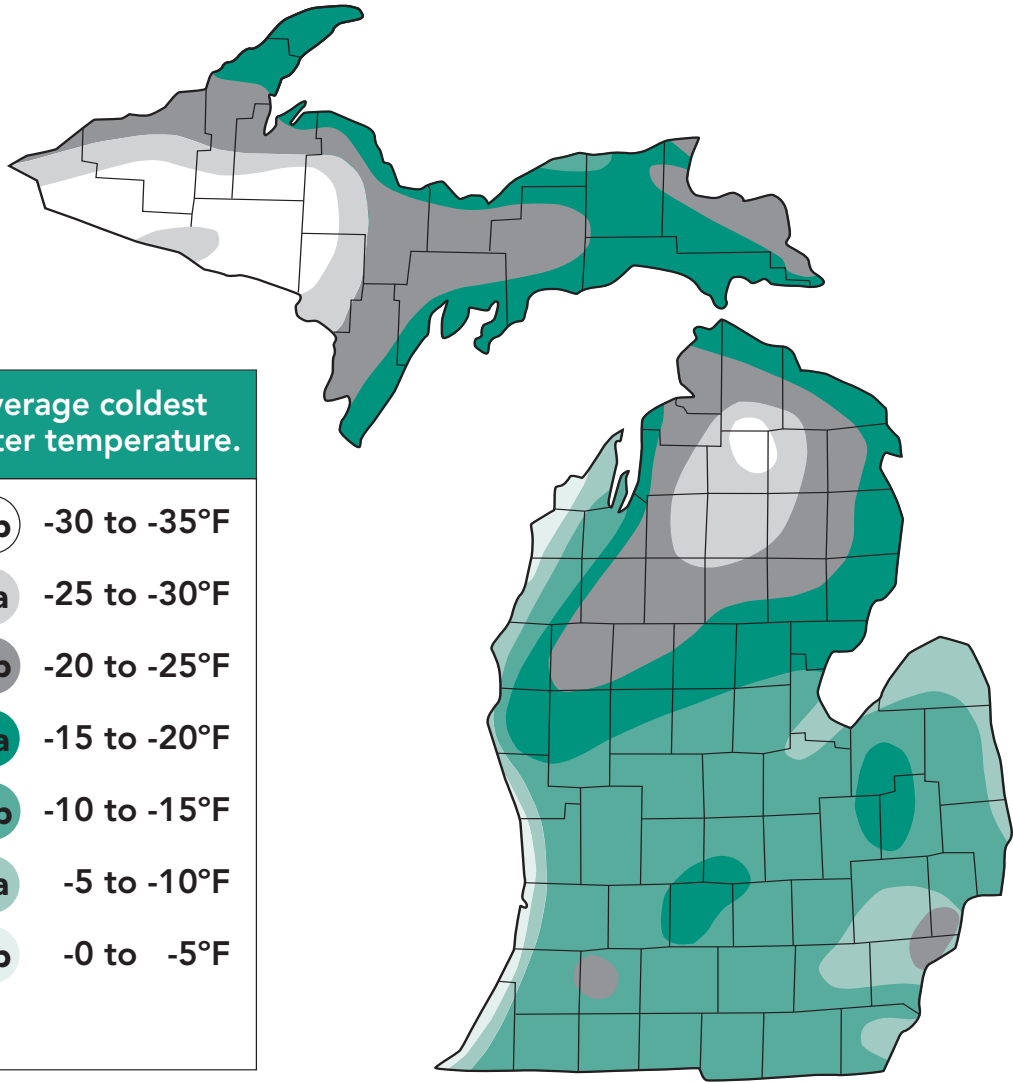


Thanks also to Keith Warren of J. Frank Schmidt & Son Company for his expertise in developing this publication.



Recommended Alternatives to Ash Trees for Michigan's Lower Peninsula

ZONE MAP



Average coldest winter temperature.	
3b	-30 to -35°F
4a	-25 to -30°F
4b	-20 to -25°F
5a	-15 to -20°F
5b	-10 to -15°F
6a	-5 to -10°F
6b	-0 to -5°F