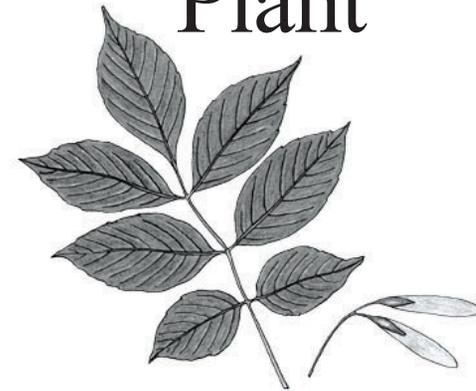


# 20 Native Trees to Plant



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# 20 Native Trees to Plant

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*The Iowa Department of Natural Resources provides a variety of services to landowners interested in tree planting, forest land management, and much more! To obtain a list of District Foresters and the counties they serve, contact:*

*Iowa DNR Forestry Bureau  
Wallace State Office Building  
Des Moines, IA 50319  
(515) 281-8681  
<http://www.iowadnr.com/forestry/>*

## Introduction

If you have ever flown in an airplane over Iowa, you would see that our woodlands are scattered along the rivers and streams and areas too steep to farm. You would also see a green carpet of trees within our cities and towns. Did you know that 90% of the over 2.7 million acres of forest in Iowa is owned by over 138,000 different private owners? Or that 30% of the land cover in a typical Iowa community is covered by trees? Trees are vital for the protection of our drinking water supply, critical for wildlife habitat, and help sustain employment of over 7,000 Iowans in the wood products industry.

This booklet “20 Native Trees to Plant” will help you gain a greater knowledge about Iowa’s trees and forests. “I think I shall never see a poem as lovely as a tree” was written by a World War I soldier, Joyce Kilmer over 80 years ago. The interest and love of our trees continues for many of us today. Learn about and enjoy Iowa’s trees. Consider ways that you can improve our environment by planting and caring for Iowa’s trees and forests. Enjoy! ■

## The Secret Life of Trees It Starts with Seeds

Seeds look and feel very differently from each other, but they’re all alike in important ways. Each of them is a baby plant with its own food supply, all put together in one handy, self-sealing package. They all have the same needs for growth: moisture, warmth, sunlight, food, and air. And they begin to grow in much the same way: moisture soaks the outer shell of the seed until it becomes soft, the food inside expands as the water enters the seed. If warmth is also present, the shell breaks open and growth begins.

A seed contains everything that’s needed to form a new plant. As growth begins, a small root pushes out of the seed and down into the earth to search for water. A tiny stem pushes up through the soil reaching toward the sunlight.

As the plant grows underground, it uses the food stored in the seed. As soon as it pushed out of the ground into the sunlight, it begins to make its own food. Food is made by the leaves’ tissues—chlorophyll—acting together with water, air and sunlight to make the kind of sugar that is food for the plant.

The youngest tree that grows from a seed is called a seedling. After a tree reaches a height of six feet or more and its trunk is one of two inches thick, it is called a sapling. The tree continues to grow as long as it lives.

## Where Growth Takes Place

Trees have three different growing parts: the root tips, the wood layers, and the buds. The root tips cause the roots to grow longer and spread out in search of more water and minerals. The wood layers are the inside of the tree, under the bark. You’ll find wood layers in the trunk and limbs. The buds of the limbs grow longer, making the tree taller and wider. This also makes it possible for the limbs to spread out to receive more sunlight.

By looking at the cross-section of a tree trunk, you can see tree growth from the center toward the outside. Look closely at the top of a stump or the end of a log, and you can see rings in the wood. These rings are made by growing layers of wood; a new layer of wood is added each year. Each layer is made up of a band of lighter colored wood called spring wood and a band of darker wood called summer wood. The spring wood band is usually wider than the summer wood band. They are called annual rings.

## Seasons Come, Seasons Go

Seasonal changes bring a lot of variety to a forest. During the spring of the year, forest life is renewed. The flowering plants, including many trees and shrubs, display their showy flowers. The broadleaf trees and shrubs bud out, then begin to cover themselves with new leaves. The evergreens develop new shoots later flare out into the new stems and needles.

During late spring and summer, all the new life that began in the spring is “growing up.” The trees in the forest have full sets of leaves. They are adding a new layer of wood around their trunks and spreading their branches wider and higher.

In the fall, the forest changes into a new kind of beauty. The leaves of broadleaf trees, shrubs, and other plants change to brilliant colors of red, yellow, and orange. Many people think frost causes this change. Actually, frost can reduce the brightness of autumn colors. The green color in leaves comes from a green material called chlorophyll. In the fall, when temperatures begin to lower (not yet freezing) and the hours of daylight shorten, the production of the green chlorophyll stops. The chlorophyll that is already in the leaves gradually breaks down until it is completely gone. Other colors in the leaves that have been there all along then show through. These colors are now seen in various shades of reds and yellows. After showing their beauty for several days or weeks, the colorful leaves fall to the ground.

Most of the trees and other plant life shed their seeds before the snow flies so the seeds will be ready to sprout into new plants when the snow melts the next spring.

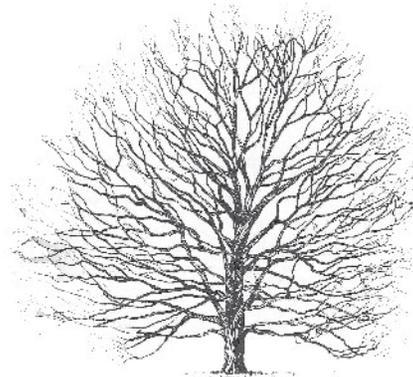
## Death of a Tree

We are part of a living and dying world. Plants and animals are born, grow up, get old, and die. Their places, in turn, are taken by other plants and animals. As each living thing dies, decays, and returns to the soil, it affects the area around it and changes the environment. One plant’s death may make it possible for new plants to grow where they could not before. ■

*This article is taken from A Teacher’s Guide to Arbor Month. Preprinted with special permission from the Minnesota Arbor Month Committee and the Minnesota Department of Natural Resources.*

## American Hornbeam

**Leaves:** Simple, alternate two and one-half to five inches long, oval, rounded or heart-shaped, sharply and doubly serrate.



**Buds:** Small, one-sixth to one-fourth inches long, narrowly ovate to oblong, pointed, reddish-brown-black, slightly hairy—often downy on edges, frequently with woolly patch of down on tip.

**Bark:** Smooth, thin, dark bluish gray, fluted with smooth, rounded longitudinal ridges.

**Distribution (Range in Iowa):** Native across the state of Iowa

**Site Characteristics:** Moist, but sufficiently drained—rich, wet soils in bottomlands along streams.

**Shade Tolerance:** Tolerant

**Growth Rate:** Slow

**Height/Spread:** 20-30 feet tall, 20-30 feet spread

**Growth Habit:** Flat or rounded-topped

**Uses:** Firewood, handles, bows, wedges and sled runners.

**Branching Pattern:** Alternate

**Fruit:** Hairy, greenish nutlet attached to the base of a three-lobed leafy bract, a number of which are arranged in a spiral in a 2 to 4 inch, cone-like cluster.

**Expected Age:** 50-100 years old

**Fall Color:** Orange to red

**Forest Fact:** Often confused with Hophornbeam which is also commonly called Ironwood. Hornbeam is also referred to as blue beech or blue ash.

Hornbeam can grow so dense in a mature woodland that it shades the ground bare of woodland plants and new forest regeneration.

**Fun Fact:** Relatively disease-free—great yard tree.



# Hophornbeam

**Leaves:** Simple, alternate, two to five inches long, oval-lanceolate, acuminate, rounded or heart shaped, dark green and hairy on top, sharply and doubly serrated, veins forming at ends; petiole one-fourth of an inch long.

**Buds:** Imbricate, small, one-eighth to one-fourth long, narrowly ovate, pointed, glabrous or finely downy, green to brown, slightly gummy especially when strongly divergent, terminal absent, scales longitudinally striate.

**Bark:** Grayish brown, stringy - thin vertical strips, slightly shredded at the ends.

**Distribution (Range in Iowa):** Native throughout Iowa

**Site Characteristics:** Upland wood; wooded slopes

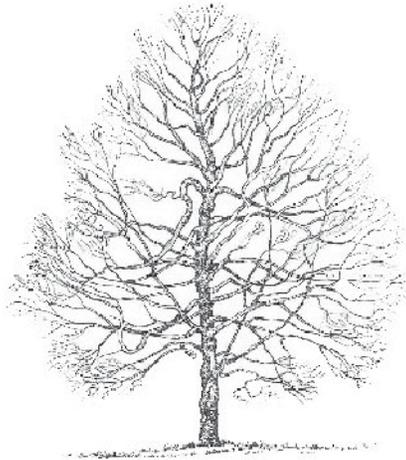
**Shade Tolerance:** Tolerant

**Growth Rate:** Slow

**Height/Spread:** 30 feet tall, 30 feet spread

**Growth Habit:** Upright pyramidal

**Uses:** The wood is dense, hard and beautiful, taking a high polish. However, the small size of trees limits commercial importance.



**Branching Pattern:** Alternate

**Fruit:** Long nut enclosed in a membrane, ovate, three-fourths to one inch long.

**Expected Age:** 60-90 years old

**Fall Color:** Yellow

**Forest Fact:** Can grow in dense patches shading the woodland understory bare, often removed prior to timber harvest to allow oak



regeneration to occur

**Fun Fact:** Great tree for tough sites in urban and yard settings.



# Black Maple

**Leaves:** Opposite, simple, three to six inches wide, deeply cordate, lobes acute, sides of leaf blade characteristically droop, stipules present, three to five inches long.

**Buds:** Plump and gray-dust-brown in color. Two axillary buds at terminal, one-half to three-fourths as long as terminal.

**Bark:** Deeply furrowed with long irregular thick plates or ridges (scaly), tremendously variable.

**Distribution (Range in Iowa):**

Native western 1/2 of the State of Iowa

**Site Characteristics:** Moist woods; wooded slopes

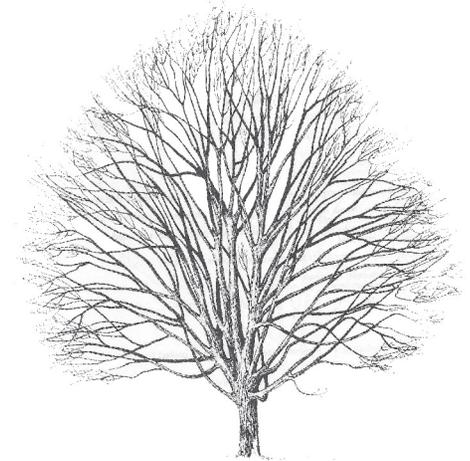
**Shade Tolerance:** Tolerant

**Growth Rate:** Moderate

**Height/Spread:** 60 feet tall

**Growth Habit:** Upright to oval

**Uses:** Flooring, furniture, cabinets, veneer, musical instruments, bowling



alleys and billiard cues.

**Branching Pattern:** Opposite

**Fruit:** Samara, glabrous, one to one and three-fourths inches long, somewhat horseshoe-shaped with nearly parallel or slightly divergent wings.

**Expected Age:** 120 to 150 years old

**Fall Color:** Yellow, burnt orange

**Forest Fact:** Black maple is often considered a cousin to Sugar Maple, but is more drought hardy.

**Fun Fact:** The great fall colors of black maples enhance tourism to NE Iowa by \$5.9 million annually.



# Bur Oak

**Leaves:** Simple, rounded lobes, quite variable in shape, usually marked by one deep pair of indentations which divides the leaves into two or more portions; leaves are somewhat hairy and white underneath.

**Buds:** Shiny, oval-shaped, one-eighth to one-fourth inches long, densely covered with fine gray hairs

**Bark:** Thick, deeply furrowed, whitish to grayish color

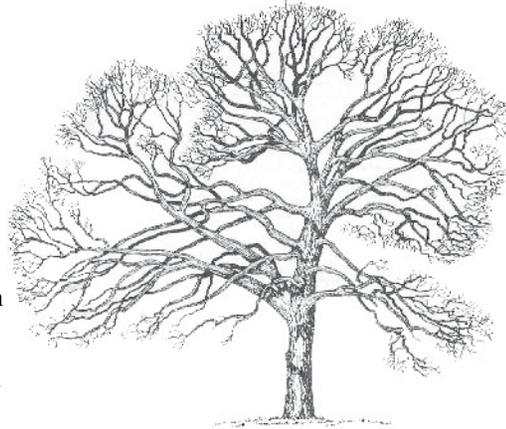
**Distribution (Range in Iowa):**

Native throughout the state

**Site Characteristics:** Primarily an upland species, occasionally found on stream terraces and floodplains; most abundant forest tree in most of western and parts of north central Iowa; very adaptable to different soil types.

**Shade Tolerance:** Intolerant

**Growth Rate:** Slow



**Height/Spread:** 60-80 feet tall, 55-60 feet spread

**Growth Habit:** Rounded

**Uses:** Pallets and railroad ties

**Branching Pattern:** Alternate

**Acorns:** Globe shaped, three-fifths to two inches long, sessile or short stalked; cup with a prominent fringe of soft

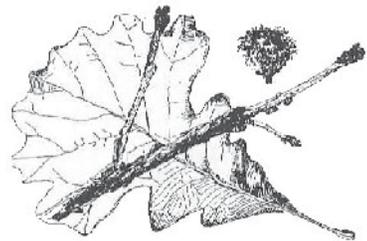
bristles around its rim, covering one-third or more of the nut.

**Expected Age:** 100-180 years in urban area; 200-300 years in a forest

**Fall color:** Yellowish-brown

**Forest Fact:** Bur oak is common across the state of Iowa. The thick bark it gets as it gets older protects it from fire.

**Fun Fact:** The fringe of soft bristles around the cup of the acorn is where this tree gets its name; a common savanna tree in pre-pioneer forests.



# Chinkapin Oak

**Leaves:** Alternate, simple, ovate to oblong-obovate, four to ten inches long, rarely rounded at base, lower portion of leaf with two to three pairs.

**Buds:** Light brown, conical shaped, one-sixth to one-fourth long.

**Bark:** Ashy-gray, rough and flaky.

**Distribution (Range in Iowa):**

Eastern to southern Iowa

**Site Characteristics:** Exposed bluffs; rocky slopes

**Shade Tolerance:** Intolerant

**Growth Rate:** Slow

**Height/Spread:** 50-75 feet tall, 40-60 feet spread

**Growth Habit:** Pyramidal

**Uses:** Wood is often combined with and sold as white oak. One time used by native peoples and pioneers as a source of food.

**Branching Pattern:** Alternative

**Fruit:** Acorn, sessile, three-fourths to one inch long, one-half enclosed by a thin cup, scales small, depressed.

**Expected Age:** 120-180 years old

**Fall Color:** Yellow to orange-brown to brown.

**Forest Fact:** Great source of mast or acorns for native wildlife. Very

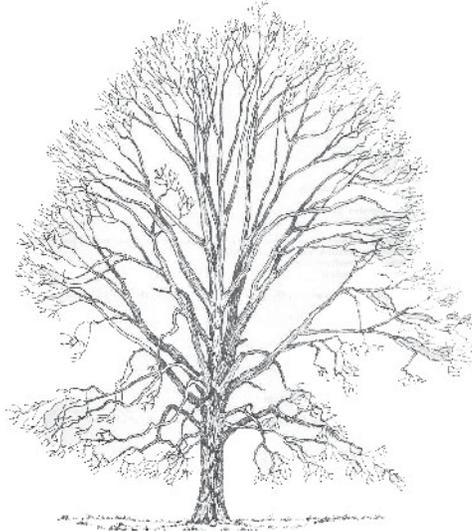
adaptable for yard tree use.

**Fun Fact:** Chinkapin oak acorns are the sweetest and least bitter of any eastern oak, and can be eaten raw.



## Northern Pin Oak

**Leaves:** Simple, alternate, sharp-lobed and bristle-tipped, 3-7 inches long and 5-7 lobes with sinuses reaching to leaf mid-vein. They are shiny, dark green and leathery.



**Buds:** Ovoid, one-fourth of an inch long

**Bark:** Dark brown to gray brown, smooth, with shallow, connected fissures.

**Distribution (Range in Iowa):**

Northern Iowa

**Site Characteristics:** Open, sandy upland woods

**Shade Tolerance:** Intolerant

**Growth Rate:** Moderate

**Height/Spread:** 50-70 feet tall,

**Growth Habit:** Irregular

**Uses:** Furniture, flooring, and interior finishing

**Branching Pattern:** Random

**Fruit:** Oval acorns, often striped, smooth and brown with a cap covering almost one-half. Produced every other year

**Expected Age:** 60-90 years old

**Fall Color:** Red

**Forest Fact:** Small acorns are favorite wildlife food of deer, turkey and native songbirds

**Fun Fact:** Northern pin oak is useful for rehabilitating disturbed sites because of its deep root system, low water potential threshold for stomatal closure and ability to adjust osmotically.



## Red Oak

**Leaves:** Simple, pointed, seven to eleven lobed, five to nine inches long, with slender petioles one to two inches long; upper surface shiny and dull green; lower surface paler and shiny except for small tufts of hairs in the axils of the bigger veins

**Buds:** One-eighth to three-eighths inches long, oval-shaped, shiny or hairy at the tip

**Bark:** “Striped look” on upper trunk, light gray to black colored on the lower trunk, thick plates and deeply furrowed; inner bark is a light red

**Distribution (Range in Iowa):** Native across the state

**Site Characteristics:** One of our most common and widely distributed oaks and lives on a variety of sites—most commonly found on moist, well-drained, sheltered slopes

**Shade Tolerance:** Intolerant

**Growth Rate:** Moderate to fast

**Height/Spread:** 70-80 feet tall, 40-60 feet spread

**Uses:** Furniture, veneer, flooring, pallets, boxes and crates, agricultural implements, lumber, firewood, and landscaping

**Branching Pattern:** Alternate

**Acorns:** One-half to one inch long; sessile; oval-shaped; cups red-brown

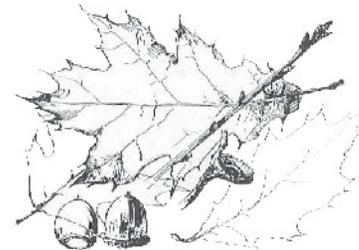
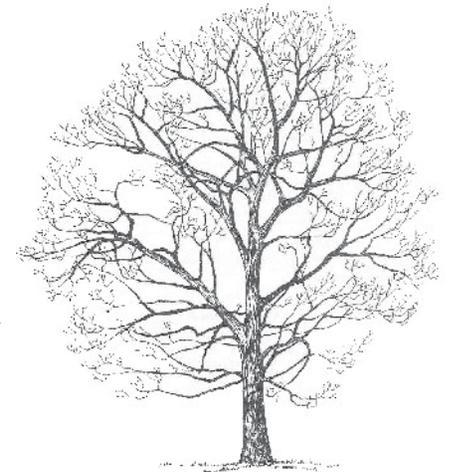
**Expected Age:** 80-120 years in urban areas; 150-180 in a forest

**Fall Color:** Red, orange-red, or deep reddish-brown

**Forest Fact:** One of the fastest growing oak

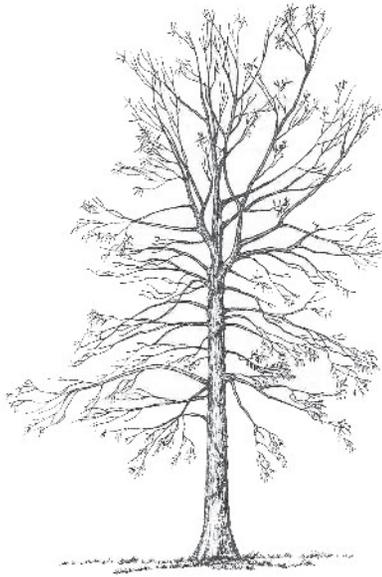
if in the sun, it is highly valued as a timber tree.

**Fun Fact:** Valuable for wildlife.



## Shingle Oak

**Leaves:** Simple, alternate, oblong or lanceolate, two and one-half to six inches long, acute at apex with bristle-like tip, dark green above, pale green or brown below; petiole one-fourth to five-eighths long.



**Buds:** Imbricate, round, sharp pointed, one-eighth to one-fourth long, brown, slightly hairy.

**Bark:** Grayish-brown, board low ridges separated by shallow furrows.

**Distribution (Range in Iowa):** southern 1/3 of Iowa

**Site Characteristics:** dry hillsides

**Shade Tolerance:** Intermediate

**Growth Rate:** Slow

**Height/Spread:** 45 feet tall

**Growth Habit:** Rounded, pyramidal

**Uses:** Street tree, shingles and general construction

**Branching Pattern:** Alternate

**Fruit:** Nut, short-stalked about five-eighths inches long, one-third to one-half enclosed in thin cup with red-brown scales.

**Expected Age:** 60-0 years old

**Fall Color:** Red-orange, brown

**Forest Fact:** This is the easiest oak to transplant and grows in tough dry locations.

**Fun Fact:** This tree has willow-like leaves.



## Swamp White Oak

**Leaves:** Simple, alternate, oval shaped, three to seven inches long, coarsely sinuate-dentate with six to ten pairs of coarse obtuse teeth, or sometimes lobed, dark green above, white or grayish green and velvety below, leathery in texture; petiole one-half to three-fourths inches long.

**Buds:** Imbricate, broadly ovate, light chestnut brown

**Bark:** Flaky, grayish brown, divided by deep longitudinal fissures into long flat ridges.

**Distribution (Range in Iowa):** Eastern 1/2 of Iowa

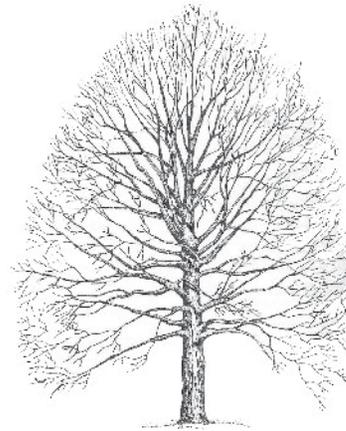
**Site Characteristics:** Low, moist conditions and bottomlands.

**Shade Tolerance:** Intermediate

**Growth Rate:** Slow

**Height/Spread:** 50-70 feet tall, 50-70 feet spread

**Growth Habit:** Pyramidal to broad



**Uses:** Excellent shade tree

**Branching Pattern:** Alternate

**Fruit:** Acorn about one inch long, usually paired one-third covered by the involucre, light brown nut.

**Expected Age:** 120-160 years old

**Fall Color:** Usually yellow, sometimes red or purple

**Forest Fact:** Great wildlife tree due to its acorns which are the last to fall in the Autumn.

**Fun Fact:** Often confused with Bur or White Oak – but more tolerant of wet soils.

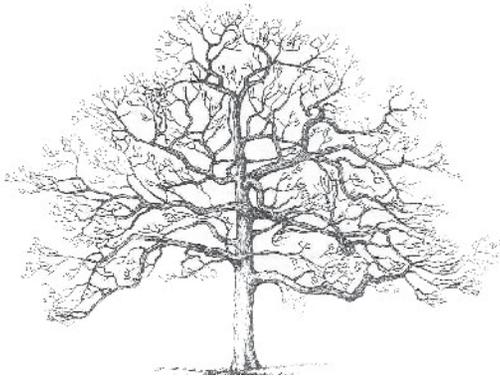


## White Oak

**Leaves:** Simple, seven to nine lobed, five to nine inches long with petioles one-half to one inch long; lobes with rounded tips, surfaces green shiny

**Buds:** Blunt pointed, shiny, one-eighth to three-sixteenths inches long

**Bark:** Light gray, often furrowed with blocky ridges on older trees, turning whitish with age.



**Distribution (Range in Iowa):**

Native in eastern, central and southern Iowa

**Site Characteristics:** One of the most abundant native trees throughout its broad range, it lives on the drier uplands woods, but can also found on moist slopes

**Shade Tolerance:** Intolerant

**Growth Rate:** Slow

**Height/Spread:** 80-100 feet tall, 40-70 feet spread

**Growth Habit:** Rounded

**Uses:** Principal wood for mine timbers, railroad ties, flooring, firewood and whiskey barrels; it is also used for fencing and posts, and is a popular paneling and furniture choice, especially for desks and tables.

**Branching Pattern:** Alternate

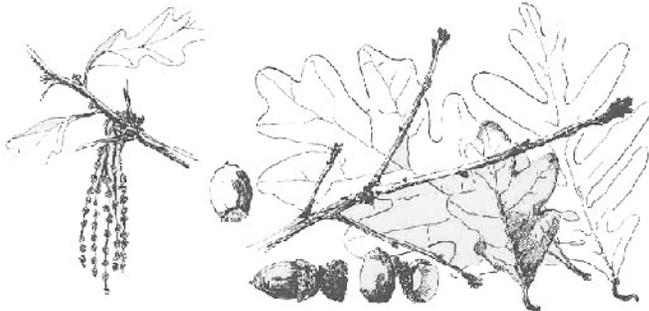
**Acorns:** One-half to three-fourth inches long, oblong and sessile

**Expected Age:** 100-150 years in urban areas; 200-400 in a forest

**Fall Color:** Turns rich purple color in October, then fades to reddish-brown and then to light brown

**Forest Fact:** Highly valued timber tree used for barrels due to its dense and non porous wood.

**Fun Fact:** Valuable for wildlife; turkey, deer, squirrels and blue jays all love this tree's sweet acorns.



## Basswood/Linden

**Leaves:** Simple, alternate, nearly round in outline, three to six inches long with petioles one and one-half to two inches long; margins toothed; base heart shaped and often unequal, surfaces shiny except for small tufts of hairs in the vein axils.

**Buds:** Shiny, three-sixteenths to one-fourth inches long, lopsided (almost heart-shaped), with two or three usually bright red scales, the terminal bud absent.

**Bark:** Smooth, light gray on young trees; becoming shallowly furrowed with long, narrow, parallel ridges.

**Distribution (Range in Iowa):** Native throughout the state

**Site Characteristics:** Moist, upland woods throughout Iowa, especially on sheltered, north and east facing slopes in stream valleys

**Shade Tolerance:** Tolerant

**Growth Rate:** Moderate

**Height/Spread:** 75-90 feet tall, 50-60 feet spread

**Growth Habit:** Oval

**Uses:** Boxes, crates, barrels, musical instruments, Venetian blind slats and veneer

**Branching Pattern:** Alternate

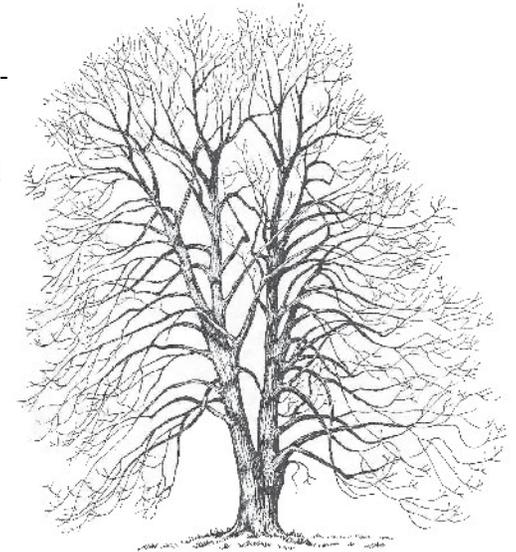
**Fruit:** Dry, globe-shaped drupe one-fourth to one-third in diameter, often persisting in winter

**Expected Age:** 60-80 years in urban area; 100-120 years in a forest

**Fall color:** Yellow

**Forest Fact:** Basswood when it gets large often get hollow and makes a great wildlife den and roosting tree.

**Fun Fact:** White blossoms can be found on this tree in the spring; attracts honey bees.



## Cockspur Hawthorn

**Leaves:** Simple, Alternate, one to four inches long, sharply serrate, shiny dark green; petiole one-fourth to one-half of an inch long.

**Buds:** Single or multi-branched in spine formation, sessile, round or oblong-ovoid with six exposed red to reddish brown scales.

**Bark:** Combination of brown and gray, often exfoliating slightly on older wood to expose an orange-red to rust-colored under bark.

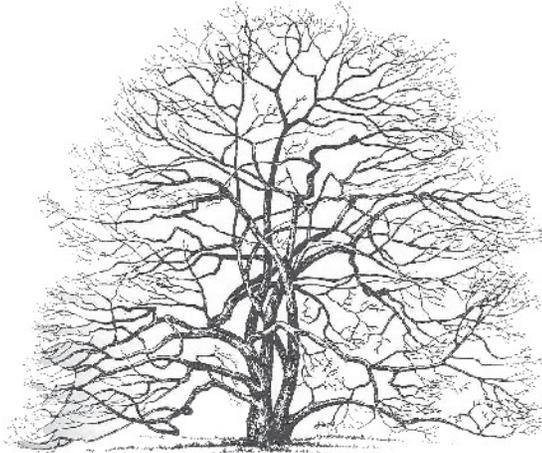
**Distribution (Range in Iowa):** Native to eastern half of Iowa

**Site Characteristics:** Open, upland woods, pastures

**Shade Tolerance:** Intermediate

**Growth Rate:** Slow

**Height/Spread:** 20-30 feet tall, 20-35 foot spread



**Growth Habit:** Broad-rounded

**Uses:** Ornamental

**Branching Pattern:** Alternate

**Fruit:** Pome-like drupe, deep red, three-eighths to one-half of an inch in diameter.

**Expected Age:** 60-90 years old

**Fall Color:** Orange to scarlet

**Forest Fact:** Strong scent of flowers draws bees and other insects.

**Fun Fact:** The long vicious thorns not only serve as protection but also provide a bit of character in the winter months when the tree has lost its leaves.



## Downy Serviceberry

**Leaves:** Alternate, simple, ovate, long-pointed at the tip, tapering or rounded at the base, finely toothed, smooth or slightly hairy, 2 1/2" - 4" inches long, prominent network of veins; shiny green above, yellow-green with tiny black dots below; leaf stalks wavy-edged.

**Buds:** Red, nearly smooth, long-pointed.

**Bark:** Red-brown, broken into an irregular pattern

**Distribution (Range in Iowa):** Native throughout state

**Site Characteristics:** Upland wood

**Shade Tolerance:** Intermediate

**Growth Rate:** Moderate

**Height/Spread:** 15-30 feet tall, 15-25 feet spread

**Growth Habit:** Rounded

**Uses:** Great for wildlife, wind-breaking, attracts birds, good landscape tree.

**Branching Pattern:** Alternate

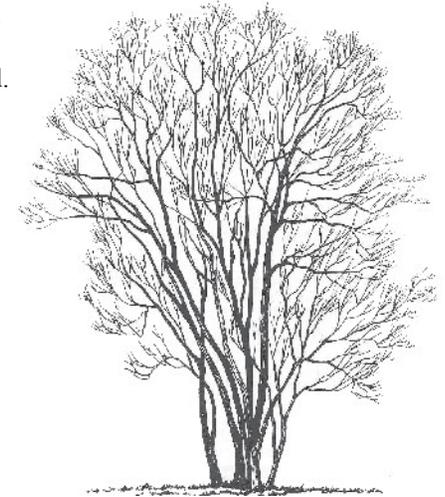
**Fruit:** Drupes oval to ellipsoid, blue-black, up to 1/2 inch long.

**Expected Age:** 15-30 years old

**Fall Color:** Red-purple

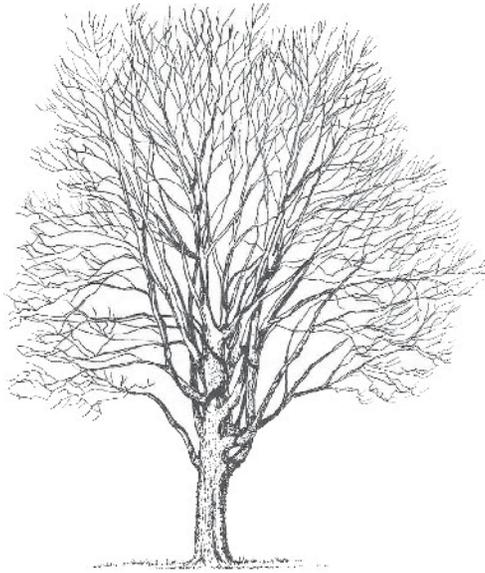
**Forest Fact:** Great plant for native wildlife habitat.

**Fun Fact:** The fruits are edible.



## Hackberry

**Leaves:** Simple, alternate, wider at the base of the leaf, two and one-half to four inches long with petioles one-third to one-half inches long, margins toothed, veins forming a network near the margin, often has nipple-like growths



**Buds:** About one-eighth of an inch long, oval to triangular shaped, closely appressed to the twig, the terminal absent, usually three or four visible bud scales, light brown, finely and rather inconspicuously hairy

**Bark:** Grayish color with warty like growth

**Distribution (Range in Iowa):** Native throughout the state

**Site Characteristics:** Moist, low-lying woods; adaptable to most soils

**Shade Tolerance:** Tolerant

**Growth Rate:** Slow

**Height/Spread:** 40-60 feet tall, 40-50 feet spread

**Growth Habit:** Upright

**Uses:** Furniture, millwork, sporting goods, and veneer for plywood and containers; good for wildlife

**Branching Pattern:** Alternate

**Fruit:** A dark purple drupe about one-third of an inch in diameter; small, hard, one-seeded pit surrounded by a thin flesh that tastes something like a prune or date

**Expected Age:** 80-100 years in urban areas; 100-120 in a forest

**Fall Color:** Yellowish-green

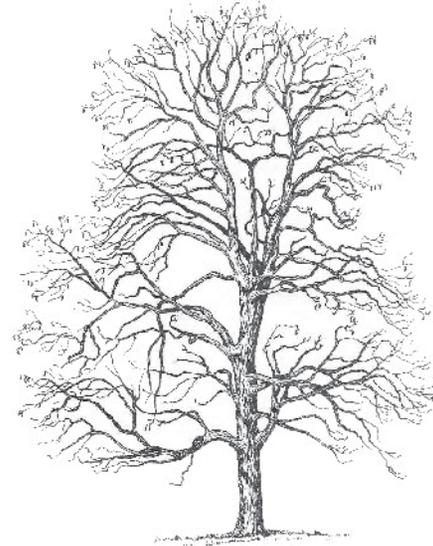
**Forest Fact:** Limited commercial value – but hardy and adaptable tree for yards and street areas.

**Fun Fact:** Hackberries are a favorite food of robins, flickers, cardinals, cedar waxwings, brown thrashers, and several other small birds.



## Kentucky Coffeetree

**Leaves:** Alternate, twice pinnately compound, two to three inches long, pointed at the tip, dark blue-green



**Buds:** Lateral buds sunken into bark, brown, hairy, two at each leaf scar

**Bark:** Smooth, dark brown to gray, deeply furrowed with curved scales.

**Distribution (Range in Iowa):** Native across the state

**Site Characteristics:** Moist, wooded ravines, alluvium

**Shade Tolerance:** Intolerant

**Growth Rate:** Moderate

**Height/Spread:** 60-75 feet tall, 40-50

**Growth Habit:** Oval and rounded

**Uses:** Cabinets, railroad ties, fence posts and rails, general construction, railway sleepers, bridge timbers, sills, interior finish, fuel.

**Branching Pattern:** Alternate

**Fruit:** Red-brown, flat and leathery legume bean pod, pointed, four to six inches long, hard seeds imbedded in a sweet pulp.

**Expected Age:** 80-100 years old

**Fall Color:** Yellow

**Forest Fact:** Hardy tree free of insect or disease issues. Underused in yard and street plantings.

**Fun Fact:** The seeds were used by the pioneers as a coffee substitute (“coffeetree”). When young tree appears to be a “broomstick” due to limited early branches – but within 10 years has a full set of strong branches.



## Nannyberry

**Leaves:** Simple, alternate, one to three inches long, pointed and finely-toothed; petiole three-eighths to one and one-fourth inches.

**Buds:** Terminal-present, five to seven scaled, imbricate, narrowly ovate, sharply pointed with silky hair at apex.

**Bark:** Smooth but streaked with fissures, gray. Old age leads to ridges, furrows and scales.

**Distribution (Range in Iowa):**

Eastern 2/3's of Iowa

**Site Characteristics:** Moist or rocky wooded slopes

**Shade Tolerance:** Tolerant

**Growth Rate:** Moderate

**Height/Spread:** 20-30 feet tall, 10-20 foot spread

**Growth Habit:** Rounded

**Uses:** Handles

**Branching Pattern:** Alternate

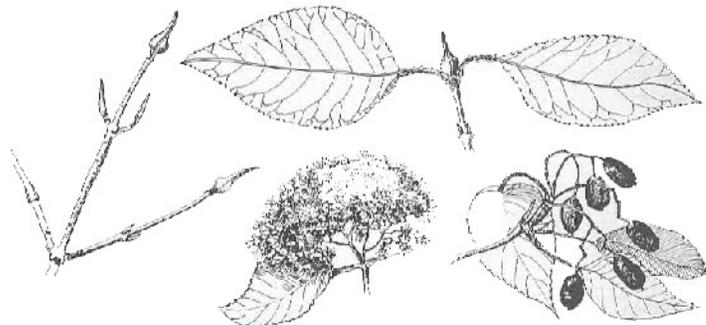
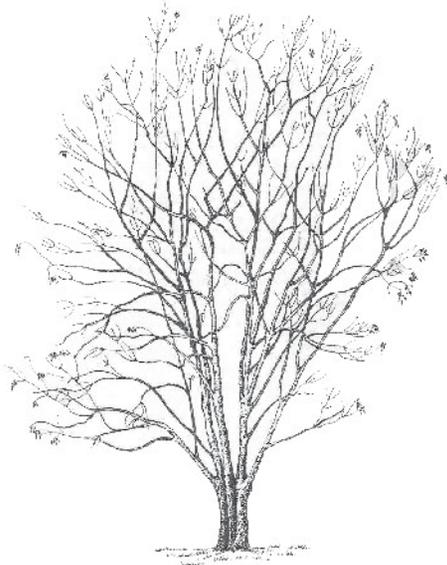
**Fruit:** Berry-like pome, orange-shaped, one-fourth to one-third in diameter.

**Expected Age:** 60-90 years old

**Fall Color:** Orange to red

**Forest Fact:** Understory tree that has fragrant white flowers in the spring. Can have a single trunk or be multi-stemmed. Fruit is a favorite of native songbirds. Great underused tree for yards.

**Fun Fact:** The fruit makes a delicious pie—as long as you get to picking before the birds do!



## Ohio Buckeye

**Leaves:** Opposite, palmately compound, five leaflets, elliptic to obovate, three to six inches long, finely serrate, medium to dark green; petiole about three to six inches long.

**Buds:** Imbricate, ovoid, sessile, terminal about two-thirds of an inch long, brown with prominently keeled scales, hairy on margins, lateral buds smaller, sticky to the touch.

**Bark:** Ash gray, deeply fissured and plated.

**Distribution (Range in Iowa):** Eastern Iowa and along the Des Moines/Raccoon River Valleys

**Site Characteristics:** Moist or sandy lowland woods

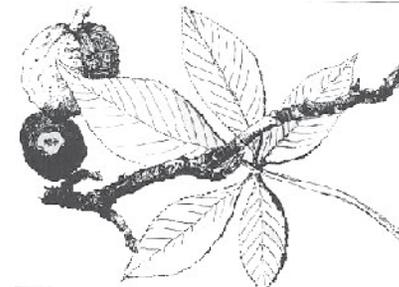
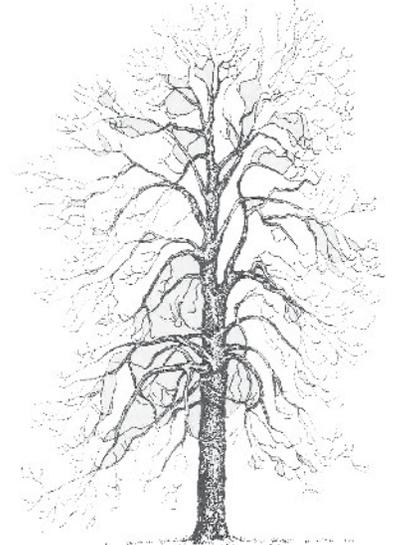
**Shade Tolerance:** Tolerant

**Growth Rate:** Moderate

**Height/Spread:** 20 to 40 feet tall, 20 to 40 feet spread, can get up to 80 feet spread

**Growth Habit:** rounded

**Uses:** Artificial limbs, boxes, crating, trunks, signs, and flooring.



**Branching Pattern:** Opposite

**Fruit:** capule, light brown, one to two inches long, broadly round with a prickly cover.

**Expected Age:** 60-80 years old

**Fall Color:** Brown-red to orange

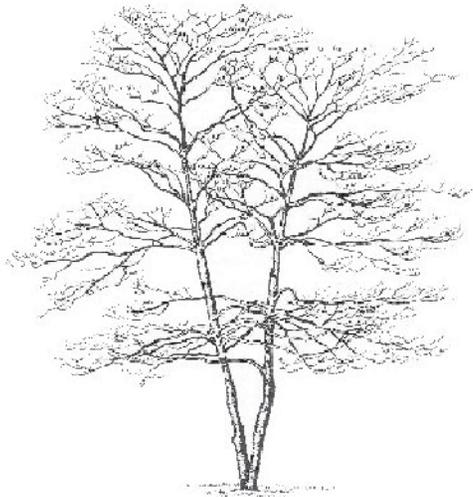
**Forest Fact:** favorite food of native wildlife

**Fun Fact:** Holding a “buckeye nut” in your pocket is considered good luck.



## Pagoda Dogwood

**Leaves:** Simple, opposite but crowded at the ends of branches, whorled-looking, elliptic-ovate, two to five inches long, wide, medium to dark green beneath, five to six pairs of veins; petiole: one to two inches long.



bark of roots, medicine from stem bark.

**Buds:** Flower, one-fourth long, purplish, vegetative, slightly hairy.

**Bark:** Smooth, purplish-green

**Distribution (Range in Iowa):** Eastern ½ of Iowa

**Site Characteristics:** Moist, upland woods

**Shade Tolerance:** Tolerant

**Growth Rate:** Slow

**Height/Spread:** 15 to 25 feet tall, 20-30 feet spread

**Growth Habit:** Rounded

**Uses:** Weaving shuttles, spool and bobbin heads, small pulleys, skewers, golf club heads, tool handles, charcoal for gunpowder, red dye from

**Branching Pattern:** Layered

**Fruit:** Drupe, bluish black, one-fourth to one-third across.

**Expected Age:** 40-60 years old

**Fall Color:** Deep red

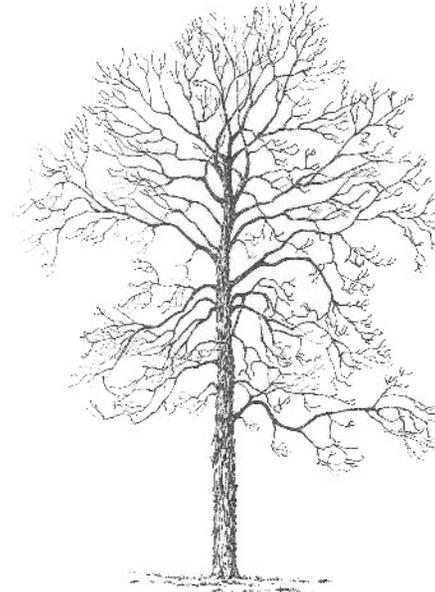
**Forest Facts:** Only native dogwood tree species in Iowa.

**Fun Fact:** Prefers acid soils, but tolerates alkaline soils.



## Shagbark Hickory

**Leaves:** Compound, eight to fourteen inches long, leaflets five in a bunch, finely toothed, and shiny; the terminal three leaflets four to seven inches long, with the other two smaller.



**Buds:** Oval-shaped, the terminal bud one-half to three-fourth inches long and the laterals smaller; the outer bud scales are dark brown and smaller; the outer bud scales are dark brown and almost shiny; the inner scales yellowish-brown and hairy.

**Bark:** Slate gray, bark runs vertically and curves away from the trunk at one or both ends—giving the tree a “shaggy” appearance

**Distribution (Range in Iowa):** Native west to the Des Moines and Raccoon rivers in central Iowa to the Missouri River in southern Iowa.

**Site Characteristics:** Upland, well-drained woodlands

**Shade Tolerance:** Intermediate

**Growth Rate:** Moderate

**Height/Spread:** 70-80 feet tall, 30-40 feet spread

**Uses:** handles of striking tools (hammers, axes, etc.) charcoal, firewood, skis and other sporting goods.

**Branching Pattern:** Alternate

**Fruit:** a nut one to two and one-half inches long, one-eighth to one-half of an inch thick, which splits open at maturity; it is green at first, then turns almost black.

**Expected Age:** 80-100 years in urban areas; 150-200 in a forest

**Fall Color:** Yellowish-green

**Forest Fact:**

Great wildlife tree

**Fun Fact:** It was the principal wood used for pioneer wagon wheels, valued as firewood.



# Witchhazel

**Leaves:** Alternate, simple, obovate or elliptic, obtusely short-acuminate, narrowed toward the base and subcordate, three to six inches long, medium to dark green with five to seven pairs of veins, petioles one-fourth to one-half long.

**Buds:** Naked, brownish, tomentose, flower buds—stalked, globose, usually three or four on a stalk.

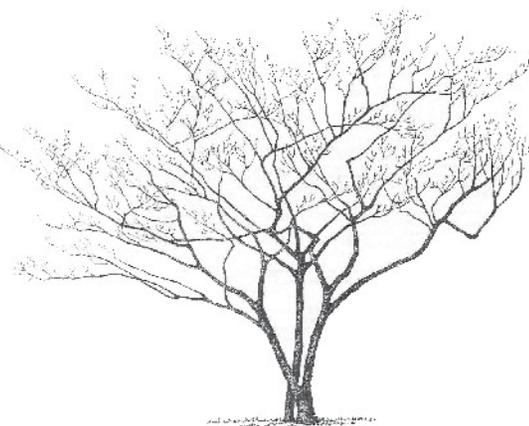
**Bark:** Smooth gray to grayish brown.

**Distribution (Range in Iowa):** Eastern ½ of Iowa

**Site Characteristics:** Moist, wooded, north-facing slopes

**Shade Tolerance:** Intermediate

Intermediate



**Growth Rate:** Moderate

**Height/Spread:** 15-20 feet tall, 15-20 feet spread

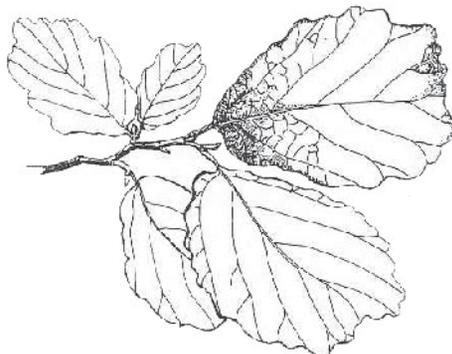
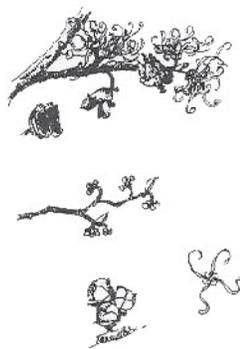
**Growth Habit:** Rounded and vase-shaped

**Uses:** As a traditional remedy, used internally and as a liniment, it is applied to varicose veins and hemorrhoids and any swollen engorged tissues. Used also to treat diarrhea—still commonly used as a remedy today.

**Branching Pattern:** Alternate

**Fruit:** Capsule, one-half long, dehiscent at the distal end

**Expected Age:** 20-40 years old



**Fall Color:** Golden yellow

**Forest Fact:** Low growing – small tree in the woodland understory

**Fun Fact:** Has supposed magical healing powers from sap extract: Used in making divining rods and worn to mend a broken heart.

# Right Tree, Right Place

**Why are you considering tree planting?** Trees are for a lifetime, so it pays to spend time now making sure you get the best to start with. Think clearly about the purpose of your new tree.

**Choose your planting site carefully.** Look up, look around, and look down. Is the site wet or dry, sunny or shady? The tree you plant today could eventually reach 40 to 100 feet in height depending on the species selected. Give your tree plenty of room to grow. Your planting site should be 15 to 30 feet away from buildings and power lines so that it won't cause damage and need massive pruning later. Consider locations of sewers and underground utilities—call 1-

800-292-8989 two working days before you dig to get exact locations.

**Select the best species.** Select the species and cultivar (variety) to plant that best matches the reasons why you are planting and the site conditions.

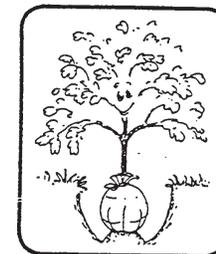
**Types of Trees.** Trees come in three forms: bareroot, containerized and ball and burlap (B&B). Bareroot trees, although less expensive, have no soil around their roots and need to be planted promptly—most commonly available bareroot tree seedlings 8 to 18 inches tall.



Containerized landscape trees—placed or grown in a pot, cost a bit more, but have some flexibility in storage and planting timing. Balled & burlap landscape trees with the original soil around their roots are most expensive, but usually result in better survival. When receiving your tree, look at the form, examine it for broken branches. Are the leaves and buds healthy and green? Are the roots moist?

**The best time to plant.** Trees can be planted anytime the ground and weather conditions permit (ex. ground not frozen or temperature not 100 degrees F). Actually, the best time to plant trees in Iowa is during the early Spring (April 1-May 30) and the late summer and early fall (August 15-November 15). Great care should be exercised to keep tree roots out of direct sunlight and strong drying winds when the temperature exceeds 50 degrees F.

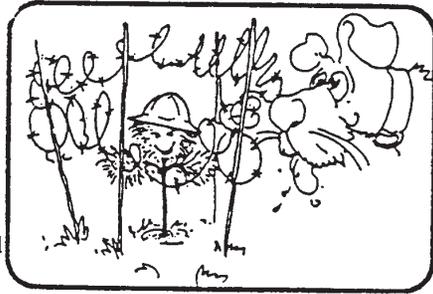
**Planting a seedling.** Dig a hole a little deeper than the length of the roots. Place the seedling in the hole with all the roots pointing into the hole, fill around it with soil. Then gently pull the trunk of the seedling up slightly to straighten out the roots. Squeeze the air pockets out of the soil, (but don't pack it too tight) and water thoroughly.



**Planting a landscape tree.** Dig a hole at least twice as wide as the roots and deep enough to allow roots to sit on level with or slightly higher than the surrounding area. Remove all the containers, or the wire baskets, place tree in hole and remove or pull back the burlap. Fill in the hole with excess soil, tap the soil, and water thoroughly.

**Give special care to your tree during early weeks of life.** Use mulch like wood chips, to conserve moisture, reduce weed competition and eliminate potential dangers from lawn mowers and weed eaters.

**Do not use grass clippings.** Water your tree at least once every 7-10 days heavily to encourage deep roots—do not water every day—shallow roots will result. Approximately 5-12 gallons per week is needed to keep your tree thriving. ■



## Glossary

- Acid soil** - Soil with a pH of 1.0 to 6.9; contains little lime  
**Acuminate** - Tapering to a slender point  
**Alkaline soil** - Soil with a pH of 7.1 to 14.0  
**Apex** - Narrowed or pointed end  
**Cordate** - Shaped like a heart  
**Divergent** - Spreading apart; pointing away  
**Drupe** - A stone fruit, such as a plum  
**Fissures** - A narrow opening or crack of considerable length and depth  
**Glabrous** - Smooth, shiny; not hairy  
**Imbricate** - Lying lapped over each other in a regular order  
**Lobed** - Divided into rounded, incompletely separate sections  
**Ovate** - Shaped like an egg  
**Petiole** - Supporting stalk of a leaf  
**Samara** - A light, winged fruit  
**Serrate** - Notched or toothed on the end  
**Sinuate dentate** - Having between wavy and pointed pointed projections  
**Sinus** - Indentation between two leaf lobes  
**Stipules** - Either of a pair of appendages born at the base of a leaf  
**Terminal buds** - Situated at the end of a branch  
**Tomentose** - Covered with densely matted hairs  
**Understory** - Vegetative layer between forest canopy and ground cover

## For more information...

*Check out the following sources for even more information about trees:*

A Guide to the Trees of Utah and the Intermountain West by Michael Huhns. Utah State University Press, Logan, 1998.

Forest and Shade Trees for Iowa by Peter J. Van Der Linden and Donald R. Farrar. Iowa State University Press, Ames, 1984.

Manual of Woody Landscape Plants; Their Identification Ornamental Characteristics, Culture, Propagation and Uses by Michael A. Dirr. Stipes Publishing Company, Champaign, IL, 1990.

Native Trees for Urban and Rural America: A Planting Design Manual for Environmental Designers by Gary L. Hightshoe. Iowa State University Research Foundation, Ames, 1978.

For a listing of trees that grow naturally in Iowa, see: <http://www.ag.iastate.edu/departments/forestry/ext/native.html>.

For additional information about many species, including information on where they grow and range maps, see: [http://www.na.fs.fed.us/spfo/pubs/silvics\\_manual/table\\_of\\_contents.htm](http://www.na.fs.fed.us/spfo/pubs/silvics_manual/table_of_contents.htm).

For more information on Plant Hardiness Zones, see The United States National Arboretum USDA Plant Hardiness Zone Map at: <http://www.ars-grin.gov/ars/Beltsville/na/hardzone/ushzmap.html>.

# Trees & Shrubs

# Native in Iowa

Common Name	Scientific Name	Height		Growth Rate	Shade Tolerance	Natural Habitat Soils/Site
		ft	m			
American Basswood	<i>Tilia americana</i>	80	24	fast	tolerant	moist, upland woods & slopes; protected bluffs & ravines
American Elm	<i>Ulmus americana</i>	70	21	medium	intermediate	woods; especially alluvial flats
American Hazelnut	<i>Corylus americana</i>	15	5	medium	intermediate	woodland openings and borders
American Hornbeam	<i>Carpinus caroliniana</i>	35	11	slow	very tolerant	moist, but sufficiently drained
Balsam Fir	<i>Abies balsamifera</i>	50	15	slow	very tolerant	steep, N-facing bluffs, limited to extreme NE Iowa
Balsam Poplar	<i>Populus balsamifera</i>	50	15	fast	very intolerant	moist woods; woodland edges
Beaked Hazelnut	<i>Corylus comuta</i>	6	2	medium	intermediate	N-facing wooded slopes; algific talus slopes
Bebb Willow	<i>Salix bebbiana</i>	25	8	fast	intolerant	moist ground; N-facing talus slopes; fens
Bigtooth Aspen	<i>Populus grandidentata</i>	45	14	fast	very intolerant	moist to dry; usually upland woods
Bitternut Hickory	<i>Carya cordiformis</i>	70	21	slow	intolerant	upland woods; wooded slopes; bluffs
Black Ash	<i>Fraxinus nigra</i>	50	15	medium	intolerant	moist, wooded slopes; alluvium
Black Cherry	<i>Prunus serotina</i>	50	15	medium	intolerant	moist, wooded slopes; upland woods
Black Maple	<i>Acer nigrum</i>	60	18	medium	very tolerant	moist woods; wooded slopes
Black Oak	<i>Quercus velutina</i>	60	18	medium	intermediate	upland woods; sandy, alluvial flats
Black Walnut	<i>Juglans nigra</i>	80	24	fast	intolerant	moist woodlands; especially alluvial woods
Black Willow	<i>Salix nigra</i>	50	15	fast	very intolerant	streambanks; lake margins; alluvial woods
Blackhaw Viburnum	<i>Viburnum prunifolium</i>	12	4	slow	intermediate	woodland borders
Blackjack Oak	<i>Quercus marilandica</i>	35	11	slow	intermediate	upland woods; SE Iowa
Blue Ash	<i>Fraxinus quadrangulata</i>	40	12	medium	intermediate	rocky bluffs
Boxelder	<i>Acer negundo</i>	50	15	fast	tolerant	alluvial woods; moist, disturbed areas; riparian areas
Buffaloberry	<i>Shepherdia argentea</i>	8	2	medium	intermediate	dry uplands; loess bluffs; prairie-woodland edges
Bur Oak	<i>Quercus macrocarpa</i>	100	30	slow	intermediate	dry uplands; slopes
Butternut	<i>Juglans cinerea</i>	60	18	slow	intolerant	moist, wooded slopes; alluvial woods

# Trees & Shrubs

# Native in Iowa

Common Name	Scientific Name	Height		Growth Rate	Shade Tolerance	Natural Habitat Soils/Site
		ft	m			
Canada Plum	<i>Prunus nigra</i>	20	6	medium	intolerant	steep, N- or E-facing, wooded slopes
Canadian Yew	<i>Taxus canadensis</i>	3	1	slow	tolerant	rocky bluffs; moist wooded slopes
Chinkapin Dwarf Oak	<i>Quercus prinoides</i>	20	6	slow	intolerant	dry ridges; rocky bluffs
Chinkapin Oak	<i>Quercus muhlenbergii</i>	50	15	slow	intolerant	exposed bluffs; rocky slopes
Chokecherry	<i>Prunus virginiana</i>	20	6	medium	very intolerant	open woods; woodland borders; rocky bluffs
Cockspur Hawthorn	<i>Crataegus crus-galli</i>	20	6	slow	intermediate	open, upland woods; pastures
Common Juniper	<i>Juniperus communis</i>	10	3	medium	intolerant	dry, wooded bluffs; rocky slopes
Common Pawpaw	<i>Asimina triloba</i>	25	8	medium	----	wooded alluvium; wooded slopes: limited to southern IA
Common Persimmon	<i>Diospyros virginiana</i>	40	12	slow	very tolerant	sandstone bluffs
Cottonwood	<i>Populus deltoides</i>	100	30	very fast	very intolerant	moist habitats; usually on alluvium; riparian areas
Coyote Willow	<i>Salix exigua</i>	25	8	fast	intolerant	streambanks; sandbars; alluvial bottoms
Dotted Hawthorn	<i>Crataegus punctata</i>	25	8	slow	intermediate	open woods; pastures
Downy Hawthorn	<i>Crataegus mollis</i>	30	9	slow	intermediate	open, upland woods; sandy alluvium; openings
Downy Serviceberry	<i>Amelanchier arborea</i>	25	8	medium	tolerant	moist, wooded slopes; rocky, wooded slopes
Eastern Red Cedar	<i>Juniperus virginiana</i>	40	12	medium	very intolerant	dry, open woods; rocky bluffs; pastures
Eastern Redbud	<i>Cercis canadensis</i>	15	5	slow	tolerant	wooded ravines; wooded bluffs; alluvium; southern IA
Eastern Wahoo	<i>Euonymus atropurpureus</i>	15	5	medium	tolerant	moist woods
Elderberry	<i>Sambucus canadensis</i>	8	2	fast	intermediate	edges of moist woods; shorelines; fencerows
Fleshy Hawthorn	<i>Crataegus succulenta</i>	30	9	slow	intermediate	open woods; woodland edges
Gray Dogwood	<i>Cornus racemosa</i>	10	3	medium	tolerant	upland woods
Green Ash	<i>Fraxinus pennsylvanica</i>	60	18	fast	tolerant	alluvial or low, moist woods
Hackberry	<i>Celtis occidentalis</i>	60	18	slow	intermediate	moist low woods; open, disturbed soil
Heart-Leaved Willow	<i>Salix rigida</i>	10	3	fast	very intolerant	streambanks; wet lowlands; ditches

# Trees & Shrubs

# Native in Iowa

Common Name	Scientific Name	Height		Growth Rate	Shade Tolerance	Natural Habitat Soils/Site
		ft	m			
Honeylocust	<i>Gleditsia triacanthos</i>	70	21	fast	intolerant	alluvial woods; old pastures; sandy prairies
Hoptree / Water Ash	<i>Ptelea trifoliata</i>	15	5	slow	intermediate	along streams; rocky bluffs; sandy habitats
Hortulan Plum	<i>Prunus hortulana</i>	15	5	medium	very intolerant	road cuts; low woods
Inland Serviceberry	<i>Amelanchier interior</i>	20	6	medium	tolerant	dry sandstone ledges
Ironwood	<i>Ostrya virginiana</i>	30	9	slow	tolerant	upland wood; wooded slopes
Kentucky Coffeetree	<i>Gymnocladus dioicus</i>	60	18	medium	intolerant	moist, wooded ravines; alluvium
Margaret's Hawthorn	<i>Crataegus margaretta</i>	30	9	slow	intermediate	upland woods; slopes; open alluvial woods
Meadow Willow	<i>Salix petiolaris</i>	10	3	fast	very intolerant	moist prairie remnants; marsh edges; fens
Mexican Plum	<i>Prunus mexicana</i>	20	6	medium	very intolerant	roadsides; fencerows
Missouri River Willow	<i>Salix eriocephala</i>	40	12	fast	intolerant	streambanks; wet lowlands; ditches
Mountain Maple	<i>Acer spicatum</i>	20	6	slow	tolerant	steep, moist, N- & E-facing wooded slopes
Nannyberry	<i>Viburnum lentago</i>	15	5	medium	intermediate	upland woods
Northern Pin Oak	<i>Quercus ellipsoidalis</i>	50	15	medium	intolerant	open, sandy, upland woods
Ohio Buckeye	<i>Aesculus glabra</i>	50	15	medium	tolerant	moist or sandy, lowland woods
Pagoda Dogwood	<i>Cornus alternifolia</i>	20	6	slow	tolerant	moist, upland woods
Paper Birch	<i>Betula papyrifera</i>	70	21	fast	intolerant	steep, sheltered, rocky bluffs; N-facing slopes; NE Iowa
Peachleaf Willow	<i>Salix amygdaloides</i>	40	12	fast	intolerant	along streams
Pear Hawthorn	<i>C. calpodendron</i>	30	9	slow	intermediate	prairie openings in upland woods; edges
Pecan	<i>Carya illinoensis</i>	70	21	slow	intolerant	alluvial woods; SE Iowa
Pignut Hickory	<i>Carya glabra</i>	70	21	slow	intermediate	dry, upland woods
Pin Cherry	<i>Prunus pennsylvanica</i>	30	9	fast	very intolerant	woods; clearings
Pin Oak	<i>Quercus palustris</i>	60	18	slow	intolerant	alluvial woods
Post Oak	<i>Quercus stellata</i>	30	9	slow	intolerant	dry, open, upland woods; SE Iowa

# Trees & Shrubs

# Native in Iowa

Common Name	Scientific Name	Height		Growth Rate	Shade Tolerance	Natural Habitat Soils/Site
		ft	m			
Prairie Crabapple	<i>Malus ioensis</i>	22	7	medium	intolerant	dry, bushy uplands; open woods; prairie remnants
Prickly Ash	<i>Z. americanum</i>	12	4	slow	intolerant	edges; upland woods; openings
Pussy Willow	<i>Salix discolor</i>	15	5	fast	intolerant	streambanks; low prairies; marsh edges
Quaking Aspen	<i>Populus tremuloides</i>	40	12	fast	very intolerant	open woods; moist prairies; woodland edges
Red Maple	<i>Acer rubrum</i>	50	15	medium	tolerant	wooded bluffs
Red Mulberry	<i>Morus rubra</i>	35	11	medium	tolerant	moist, alluvial woods; wooded slopes
Red Oak	<i>Quercus rubra</i>	70	21	medium	intermediate	moist, upland woods
Red-Osier Dogwood	<i>Cornus stolonifera</i>	8	2	fast	tolerant	shores; lake & pond margins; fens
River Birch	<i>Betula nigra</i>	80	24	fast	intolerant	alluvial woods; stream margins
Rock Elm	<i>Ulmus thomasii</i>	70	21	medium	intermediate	bases of moist, wooded slopes
Rough-Leaf Dogwood	<i>Cornus drummondii</i>	8	2	medium	tolerant	moist woods; along streams; woodland borders
Roundleaf Dogwood	<i>Cornus rugosa</i>	8	2	medium	tolerant	rich, upland woods; N-facing, wooded slopes
Roundleaf Serviceberry	<i>A. sanguinea</i>	20	6	medium	tolerant	sandstone ledges; algific slopes
Sandbar Willow	<i>Salix interior</i>	30	9	fast	intolerant	streambanks; sandbars; alluvial bottoms
Saskatoon Serviceberry	<i>Amelanchier alnifolia</i>	18	5	medium	tolerant	thickets; margin of lakes
Shagbark Hickory	<i>Carya ovata</i>	70	21	slow	intermediate	dry, upland woods; bluffs; statewide
Shellbark Hickory	<i>Carya laciniosa</i>	70	21	slow	very tolerant	alluvial woods; southern Iowa
Shingle Oak	<i>Quercus imbricaria</i>	45	14	slow	intermediate	bottomlands; dry hillsides; southern Iowa
Shining Willow	<i>Salix lucida</i>	25	8	fast	intolerant	low, moist ground; lakeshores; streambanks; fens
Showy Mountainash	<i>Sorbus decora</i>	20	6	medium	intolerant	hedges; woodland margins; sandstone outcrops
Silky Dogwood	<i>Cornus obliqua</i>	10	3	medium	tolerant	wet thickets; low woods; wet prairies
Silver Maple	<i>Acer saccharinum</i>	120	36	very fast	tolerant	alluvial woods; riparian areas
Slippery Elm	<i>Ulmus rubra</i>	60	18	medium	tolerant	wooded slopes & bluffs

# Trees & Shrubs

# Native in Iowa

Common Name	Scientific Name	Height		Growth Rate	Shade Tolerance	Natural Habitat Soils/Site
		ft	m			
Smooth Sumac	Rhus glabra	15	5	medium	intermediate	woodland openings; edges; disturbed areas
Speckled Alder	Alnus incana	30	9	medium	intermediate	sandy soil in alluvial woods; streamsides; seeps
Staghorn Sumac	Rhus typhina	20	6	medium	intermediate	dry openings in woods; edges; rocky slopes
Sugar Maple	Acer saccharum	60	18	medium	very tolerant	moist woods; wooded slopes
Swamp White Oak	Quercus bicolor	70	21	slow	intermediate	alluvial woods
Sycamore	Platanus occidentalis	100	30	fast	intermediate	alluvial woods
White Ash	Fraxinus americana	70	21	medium	intolerant	upland woods
White Oak	Quercus alba	100	30	slow	intermediate	uplands woods; dry slopes
White Pine	Pinus strobus	90	27	medium	intermediate	sandy or rocky, steep, wooded slopes & ledges
Wild Plum	Prunus americana	20	6	fast	very intolerant	fencerows; woodland edges; open woods
Witchhazel	Hamamelis virginiana	10	3	medium	intermediate	moist, wooded, N-facing slopes
Yellow Birch	Betula alleghaniensis	100	30	medium	intermediate	N-facing, rocky, wooded slopes

**Adapted from:**

*Trees and Shrubs Native to Iowa*

*Iowa State University Forestry Extension*

*Ames, IA 2001*

*Manual of Woody Landscape Plants; Their Identification, Ornamental*

*Characteristics, Culture, Propagation and Uses*

*Michael A. Dirr*

*Athens, GE 1990*