

Landowners Guide to:

## UNDERSTANDING THE IMPORTANCE OF WHITE OAK

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FOR-147

### Introduction

White oak (*Quercus alba*) is considered the most important hardwood tree species in the eastern United States. Most of us, regardless of whether we focus on wildlife, timber, or recreation, agree with this. There are many reasons to hold white oak in such high regard. White oak is long-lived, easily surpassing 200 years or more with some living to 500 years. White oak is one of the most widely distributed of all the oaks growing on a wide range of soils and sites over a very large geographic area. As a result, white oaks are often important landmark trees, having historical or cultural significance. White oaks are also critically important today as a keystone species of the central hardwoods region's green infrastructure. In addition, white oak trees have tremendous potential to help address climate change by sequestering carbon in extensive root systems and through long-lived wood products. The species is seen as a majestic and stable representation of our landscape whether planted in urban areas or found in their natural habitat in rural and secluded forests. This results in many who have a personal association with white oak.

### Wildlife Value

The value of white oak is not solely related to how long it lives or its widespread occurrence. White oak has special characteristics which make it ecologically and economically important. White oak provides significant food and shelter for both game and non-game wildlife species. Let's first consider the acorn. White oak acorns are one of the most palatable of all the oaks. This is due to their relatively low concentration of tannic acid that makes other acorns bitter. While we would find white oak acorns distasteful, they are a highly digestible source of food and many species of wildlife thrive on them. This is obvious from September through November, when acorns are falling from the trees. Deer, turkeys, and squirrels, to name only a few, can often be found under white oaks scratching, raking, pawing, and digging through the leaves to get to the nutritious acorns that are an important staple during the winter months. However, acorns are not the only source of food provided by white oak. The tender buds and new shoots of seedlings and saplings in the spring, are perfect for browsing by deer. Even rabbits can be found eating young bark and twigs.

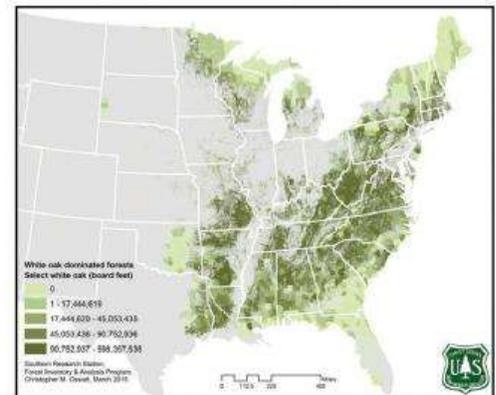


Figure 1: White oak is widely distributed across a large geographic area. Photo courtesy: USDA Forest Service

This publication is part of the White Oak Initiative's ([www.whiteoakinitiative.org](http://www.whiteoakinitiative.org)) **Landowners for Oaks Series** designed to provide foundational information necessary for sustainable management of white oak and upland oak forests.

The **Landowners for Oaks Series** is produced by the Cooperative Extension Service, University of Kentucky, Department of Forestry and Natural Resources (<http://ukforestry.org>) in support of the White Oak Initiative.

Authors: Dr. Jeff Stringer and Darren Morris, UK Forestry and Natural Resources. Published as University of Kentucky's Cooperative Extension publication FOR-147.

Funding for the **Landowners for Oak Series** was provided by the Kentucky Division of Forestry through the Upland Oak Sustainability and Management Project sponsored by USDA Forest Service, State and Private Forestry, Landscape Scale Restoration Program.

Along with food, white oak also provides significant habitat and shelter for a host of wildlife species. Mature trees develop cavities which can be used by a wide range of wildlife including birds, squirrels, and raccoons. Many birds nest in white oak, such as the near threatened cerulean warbler that spends much of its time hopping around from branch to branch feeding on insects in the canopy of mature white oaks. The cavities and flaky bark of white oaks are also used as hiding places in the summer by a number of forest dwelling bats, some of which are federally protected. Oaks, including white oak, are also home to more species of Lepidoptera (moths and butterflies) than any other tree species, making them an important food destination for many species of wildlife. White oak provides significant food and shelter to many different species of wildlife and is critical to the overall health of the ecosystem.



Figure 2: Newly emerging white oak leaves provide browse for deer.

### Commercial Value

Most oaks are important providers of forest products and white oak is no exception. White oak provides a wider range of products to the forest product industry than most other oaks. Lower quality white oak, possessing knots or other blemishes, is harvested for a number of lower valued products such as pulpwood for paper production, logs for manufacturing pallets, crossties for railroads, and the sawing of lower quality lumber.



Figure 3: These white oak logs have been laid out on the log yard to be sorted based on quality and hauled to the appropriate markets.

On the opposite end of the spectrum, high quality white oak trees, with no branches, knots or other signs of degrade are harvested for highly valued wood products. The pattern of the grain and color of white oak wood make it sought after in manufacturing veneer, the highest valued forest product. Along with veneer, these trees yield wood used in the production of highly valued lumber for furniture, cabinets, and flooring. White oak also has wood properties that make it uniquely suited for manufacturing barrels used by the wine and whiskey industries. Logs used in the manufacture of barrels are called stave logs (staves being the vertical pieces of wood in a barrel). White oak wood cells are naturally occluded with a growth called tyloses which greatly reduces leakage, a highly useful trait if you are aging whiskey, wine, or other spirits for several years. Few other species have this characteristic. Further, the charred white oak wood in a barrel, contributes all of the color and seventy percent of the flavor to bourbon whiskey. All of these characteristics result in white oak being used by a large number of wood product industries which creates steady competition for white oak timber and logs and is the reason for its place as one of the most historically sought after commercial hardwood species.

### How White Oak Regenerates

Unfortunately, not everything about white oak is ideal, especially when it comes to regenerating white oak in existing forests where there are some hurdles to overcome. White oak happens to be one of the slower growing upland oaks, often slower growing than many of the tree species they compete with. Because white oaks are slow growers, they are at a disadvantage when it comes to keeping pace with competing species after a timber harvest or a storm that opens up the canopy.

In order to ensure that white oak has a good chance of becoming a part of the next forest stand, white oak seedlings need a head start. This means making sure white oak seedlings are growing in the understory prior to harvesting timber. This "advance regeneration" is a key component of upland oak forest management.

An important factor in establishing regeneration is acorn production. This brings up another characteristic that makes managing white oak difficult. It turns out that most white oaks only have good acorn producing crops every few years. These bumper crops are necessary to ensure that enough acorns are present so wildlife does not consume all of them before they have a chance to germinate and become seedlings. Further, if an acorn is to have a good chance at germinating and growing into a seedling, it is necessary for them to be in direct contact with the soil. White oak acorns germinate in the fall, sending out a small root from the acorn. If the acorn is not lying on the soil, covered with newly shed leaves, it is susceptible to drying out. Animals also can help white oak by burying acorns, further helping to protect them from drying out. Keeping the acorns out of sight, also helps



Figure 4: This white oak seedling is currently too small and will not survive to become a mature tree unless it is developed into a larger (advance regeneration) oak.

some of them avoid being eaten. The contact with the soil helps firmly establish a root that can successfully live over the winter. This is required so that when the top emerges in the spring it is provided with abundant water and nutrients. Without a vigorous root the top will soon wither and die.

To successfully regenerate white oak an abundance of seedlings and saplings, advance regeneration, must become established in the understory. This is required so when a complete or partial opening in the forest canopy occurs and increases the amount of light to the forest floor, white oak seedlings and saplings can outgrow competition, eventually maturing to become a dominate tree of the forest. It is important to note that this canopy disturbance can be a result of a timber harvest or naturally caused by wind or ice storms. Regardless, when this occurs, vigorous white oak seedlings and saplings must be present in advance, because a newly emerging one-year-old seedling does not have enough vigor to compete and will soon

be overgrown. Specific management techniques have been developed to provide the conditions described above. Some have been developed to increase the number of seedlings, some to improve the vigor of seedlings, and some to ensure that small-and medium-size oaks continue to grow well.

### Important to All

White oak is clearly an important component of our forests. Not only is white oak an important timber resource, but it is also one of the most highly valued wildlife trees in the eastern United States. All of these reasons compel us to work towards sustaining this important resource. The use of oak-friendly management practices is a key element in ensuring that white oak forests continue to successfully regenerate and thrive.



Figure 5: This oak regeneration is approximately 4 feet tall and contains vigorous white oaks capable of outgrowing competition.

**The photos at the top of page one represent a few of the many benefits and uses of white oak, making it one of the most important tree species in the Eastern United States. Photos and images courtesy of the authors or the University of Kentucky Department of Forestry and Natural Resources unless otherwise noted.**

For more information about white oak and white oak management, refer to other White Oak Initiative - Landowners for Oaks Series publications. Landowners Guide to: Identification and Characteristics of Upland Oaks provides information about the characteristics and identification of eight important upland oaks (including white oak) that are commonly found in upland oak forests. Landowners Guide to: Challenges Of Upland Oak Regeneration delves deeper into the complex processes necessary for successful oak regeneration. Landowners Guide to: Sustainable Oak Management Practices provides a basic overview of oak management practices that are necessary management tools for growth, development, and maturity of healthy upland oak forests.

Stringer, J., and Morris, D. 2022. Landowners Guide to: Understanding the Importance of White Oak. Cooperative Extension Service, University of Kentucky, Department of Forestry and Natural Resources, FOR-147. 3pp.

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***Quercus alba* (White Oak)**  
**Beech Family (Fagaceae)**

**Introduction:**

*Quercus alba*, the “white oak,” is a member of the white oak group with lobed leaves. *Quercus alba*, one of the most majestic of all grand oaks, is prominent throughout the eastern deciduous forest. In spring, its unfurling leaves are rose-colored and mature into a dark green. This oak has fine fall color and its leaves persist into winter. It draws its name from its ash-colored bark.

**Culture:**

White oak prefers full sun and moist, well-drained, acidic soil (pH 5.5 to 6.5). It is tolerant of drought once established, but will not tolerate alkaline or poorly drained soil. Most white oaks develop chlorosis, or yellowing of leaves, when grown under high pH conditions.

White oak will decline slowly if subjected to root disturbances such as soil compaction, cutting surface roots, decreases in leaf litter, or changes in soil drainage conditions. As little as 1 inch of fill soil can kill an oak.

White oak may be bothered by bacterial leaf scorch and two-lined chestnut borer. Other potential problems for oaks in general include obscure scale, oak horn gall and gypsy moth.

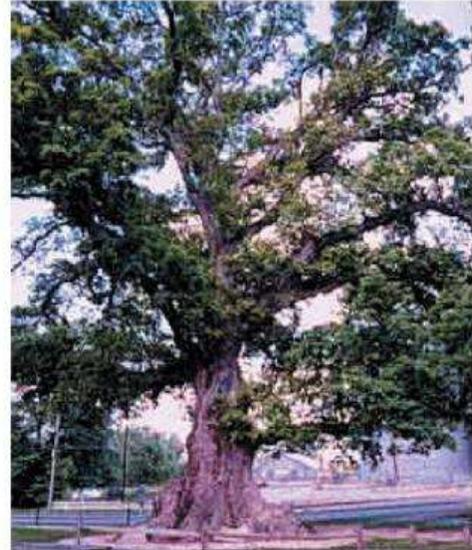
**Additional comments:**

Although white oak has wide, outspread limbs, its strong wood prevents storm or ice damage. Its well-developed tap root makes white oak somewhat difficult to transplant and for this reason, it is not widely available in the nursery industry. White oak can produce an abundant number of acorns.

White oak is not only the namesake for this group of oaks, it is a superior landscape and natural oak species. It is not as common in the nursery trade as the red oaks, but is well worth including in cultivated landscapes where space permits.

*Quercus* is the Latin name for the oak tree; the specific epithet, *alba*, is Latin for white, referring to this tree’s beautiful light-colored bark. Fall color in white oak is variable, but some white oaks have a brown to red color in autumn.

White oak wood has been traditionally used to make baskets and is widely used for making barrels for aging bourbon. The former national champion white oak (pictured above) located in Wye Mills State Park in Maryland, was 96 feet tall until it died in a storm in 2003.



**Botanical Characteristics:**

**Native habitat:** Central and eastern North America; Kentucky native.

**Growth habit:** Characteristic huge, wide-spreading crown.

**Tree size:** Can attain a height of 60 to 100 feet over its potentially long life of 800 years.

**Flower and fruit:** Female flowers are inconspicuous; however the pendulous male catkins look like a cloud of green smoke. The 1-inch long acorn has the top 1/4 covered by a scaly cap.

**Leaf:** Glossy green above and pale below, the large leaves are deeply lobed and have a tapered base. Fall color ranges from brown to rich red.

**Hardiness:** Winter hardy to USDA zone 3.



# Chinese Chestnuts

Cheryl Kaiser<sup>1</sup> and Matt Ernst<sup>2</sup>

## Introduction

American chestnuts (*Castanea dentata*), once prominent in the eastern U.S. landscape, all but disappeared in the mid-1900s when chestnut blight eradicated nearly all of these popular trees. Blight-resistant varieties of Chinese chestnut (*Castanea mollissima*) and their hybrids are viable alternatives for commercial chestnut production.

Chestnuts are low in fat compared with other nuts and are receiving attention from the health food industry. These nuts are eaten roasted, boiled, or sautéed. Chestnuts may be incorporated into various recipes, such as stuffing, vegetable dishes, casseroles, and desserts. Dried chestnuts can be ground into flour as a substitute for wheat flour or corn meal.

## Marketing

The most promising outlets for chestnuts include the domestic fresh (roasting) markets, upscale restaurants, and ethnic/specialty food groceries. Chestnuts can also be used to make gluten-free chestnut flour for sale as a specialty food. Specific fresh chestnut markets include restaurants, roadside stands, on-farm markets, farmers markets, retail groceries, and specialty food retailers. The University of Missouri Center for Agroforestry reported selling direct to consumers from on-farm stands and farmers markets, and selling direct to restaurants, as the most common marketing methods. Chestnut growers in the Eastern U.S. have also sold chestnut value-added products online.

Chestnuts are often considered a holiday food item, so growers could take advantage of this potential market by timing sales accordingly. Demand for chest-



nuts peaks from September through December, then declines dramatically. Proper post-harvest handling, including cold storage and marketing the chestnuts from refrigerated containers at retail, is essential for maintaining market quality. Because consumers are relatively unfamiliar with chestnuts, the producer will want to provide recipes and instructions for use and handling at the point of sale.

## Market Outlook

Chestnuts have potential for production on marginal land in Kentucky. Local growers who can consistently supply high quality, good tasting, and weevil-free chestnuts have the advantage of freshness over imported chestnuts, which may be viewed by consumers as expensive or of lesser quality. However, many U.S. consumers are unfamiliar with chestnuts, and chestnut growers will need to be willing to educate and promote their crop to a new generation of consumers.

Michigan is the leading chestnut state with 360 bearing acres in 2017. California and Florida also have around



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300 bearing acres, with larger acreages per farm than Michigan. The number of states reporting 100 or more acres of chestnut trees for nuts increased from eight in 2012 to 13 in 2017, according to the 2017 Census of Agriculture. Iowa, Missouri, Ohio and Virginia tallied substantial new plantings since 2012.

Marketing channels for U.S.-grown chestnuts have mainly focused on niche, upscale foodservice and specialty food markets. Production for local sales, such as at farm festivals, is a possible way to add value to small-scale production. The agricultural cooperative Chestnut Growers, Inc., developed as a processing and marketing outlet in Michigan, as has the Route 9 Cooperative in Ohio, where its members could access a commercial-scale chestnut peeler for processing.

## **Production Considerations**

### *Planting material and cultivar selection*

Chestnut trees may be established from seeds, seedlings, or grafted trees. Planting grafted trees is preferred for consistency in yield, ripening, size, and quality of the nuts produced. While seedling trees are generally more readily available and less expensive to purchase, grafted trees come into bearing sooner than seedlings. Grafted trees should have a genetically similar rootstock to avoid delayed graft incompatibility several years after planting. Grafted tree survival is more likely when the rootstock is a seedling of the scion cultivar.

There are a number of Chinese chestnut cultivars and hybrids that are well adapted to Kentucky conditions. Nut characteristics, such as size, flavor, cracking quality, and storage life can vary among varieties. It is particularly important to choose selections resistant to chestnut blight, and cultivars that produce the largest nuts such as Qing. Most markets require large chestnuts. Chinese chestnuts are self-sterile, so two or more different cultivars are required for good pollination. Refer to Nut Tree Growing in Kentucky (ID-77) for recommended varieties. Custom grafted trees may have to be ordered a year in advance.

### *Site selection and planting*

Chestnuts can be grown on land that is considered unsuitable for other crops, such as sandy or gravelly soils. Heavy, poorly drained sites should be avoided, as chestnuts are very susceptible to Phytophthora root rot. Chestnuts prefer soils that are somewhat acidic

(pH 5.5 to 6.5) and will not tolerate high pH soils. While trees are cold hardy when dormant, swelling buds are susceptible to frost damage in the spring. Do not plant in frost pockets or locations with poor air drainage.

Mature chestnuts require a final 40 feet by 50 feet spacing; however, it may take 20 or more years before trees actually fill this space. Some growers interplant chestnut seedlings at a closer spacing among grafted chestnuts. As the permanent grafted trees mature and come into full production, these filler trees are removed.

Trees are trained to a modified central leader shape, with only limited pruning needed on bearing trees. Young trees require protection against sunscald injury to their smooth bark with white spiral trunk guards. Supplemental watering helps promote tree growth and to reduce stress, especially in the first year. Once established, trees are relatively drought tolerant; however, irrigation will help bearing trees to produce larger nuts and improve nut fill.

### *Pest management*

Eliminating undesirable vegetation prior to planting is essential for tree establishment. Weeds should be controlled within 3 feet of young trees. Weed control strategies include the use of herbicides and mowing between tree rows. Chestnut blight is still present in the U.S., but using blight-resistant varieties may reduce disease incidence. Potential insect problems include aphids, Japanese beetles, potato leafhoppers and chestnut weevil. Insecticide applications will be required annually for weevil control and as needed to control Japanese beetles. The Asian chestnut gall wasp (ACGW) is also present in Kentucky. Biological control through parasitoids is showing some control. There are no insecticides cleared for ACGW, but adult wasps are easily killed with sprays applied for Japanese beetle.

Young trees are very prone to damage by animal pests, such as rabbits, mice, squirrels and deer. These pests will need to be controlled to reduce nut losses. Placing plastic guards around each tree soon after planting will help deter feeding damage from voles or rabbits when population pressure is low. Deer fencing and tree shelters should be used until trees are large.

### *Harvest and storage*

The first harvest for seedling chestnuts can be expected in five to six years. Grafted trees will begin to bear within three to five years, with larger yields beginning six to nine years after planting. Soil moisture is important prior to harvest because half the kernel growth takes place during the last two weeks before ripening.

Chestnuts are hand-picked off the ground once they have fallen from the tree. Daily harvesting is necessary to prevent the fallen nuts from drying out and to ensure that area wildlife does not steal or damage the crop. Alternatively, where deer or squirrel losses are severe, nuts in burs may be shaken from the tree once the burs begin to split. Chestnuts harvested too early will be smaller, softer in texture and hard to remove from burrs.

Harvested nuts are separated from any debris gathered at harvest and cleaned so they are free of dirt. Promptly refrigerate (32° F or slightly above) in ventilated plastic bags. Nuts should not be allowed to dry out. Curing and storing chestnuts is a fairly involved process, and interested individuals should consult the harvesting and storage article from Michigan State University listed in the Selected Resources at the end of this document.

### *Labor requirements*

Based on 1,000 to 2,000 pounds produced per acre, labor needs are approximately 80 hours for establishment in the first two years, 25 hours for production, 70 hours per ton for hand harvest, and 16 hours per ton for packaging and grading.

### **Economic Considerations**

Chestnuts require three to six years for establishment before any nuts may be harvested, and 10 years before yields are significant. This delay will mean a period without any cash income, presenting a significant financial and production risk. For this reason, many chestnut growers start with the crop as a hobby or source of generating farm income from underutilized land.

Initial investments for chestnuts include land preparation, the purchase of trees, deer fence installation and the installation of an irrigation system. Other costs may include a sprayer, a nut shaker, cleaning equipment, a grader, and cold storage. Significant costs may



be incurred protecting seedlings from animal pests. Substantial losses due to graft incompatibility may also occur if grafted trees are not selected carefully.

Establishment costs will vary depending on production systems and tree costs. Total establishment costs for 1 acre of chestnuts in Kentucky would likely range from \$4,500 to \$8,000 per acre for the first five years of grafted tree production. Estimates from Michigan calculate a five-year establishment cost at \$7,797, including a \$1,187 deer fence cost. Estimates for Kentucky production (2019), based on a price of \$2.50 per pound, show establishment costs recouped after seven to nine years. Annual returns to labor, land and management of \$1,000 to \$1,450 per acre of chestnuts could be realized after year 7.

Financial returns may increase as trees mature and produce substantially greater yields of nuts per acre. Higher prices will also generate greater profitability from chestnuts. Product quality (particularly, weevil-free) and market development are essential for profitable chestnut production. Potential chestnut producers can utilize a detailed financial projection tool, developed by the University of Missouri Center for Agroforestry, to estimate long term profitability.

### **Selected Resources**

- Nut Tree Growing in Kentucky, ID-77 (University of Kentucky, 2007) <http://www2.ca.uky.edu/agcomm/pubs/id/id77/id77.pdf>
- Chestnuts (Michigan State University Extension) <http://msue.anr.msu.edu/topic/info/chestnuts>
- Chestnut Growers, Inc. <http://www.chestnutgrowersinc.com/>

- Chestnut Decision Support Tool (University of Missouri Center for Agroforestry, 2012) <http://www.centerforagroforestry.org/profit/> (under Specialty Crops: Chestnuts)
- Chestnuts (Agricultural Marketing Resource Center, 2018) <http://www.agmrc.org/commodities-products/nuts/chestnuts/>
- Commercial Chestnut Costs of Production and Comparative Analysis with Tart Cherry Production (Michigan State University, 2013) <https://www.canr.msu.edu/chestnuts/establishing-orchards/cost-of-production>
- Chestnut: American Chestnut (Northern Nut Growers Association, Inc., 2009) <https://nutgrowing.org/research-and-resources/types-of-nut-trees/chestnut-american-chestnut/>
- Growing Chinese Chestnuts in Missouri (University of Missouri Center for Agroforestry, 2012) 6.74 MB <http://www.centerforagroforestry.org/pubs/chestnut.pdf>

- Commercial Chinese Chestnut Production in Virginia (Virginia Tech, 2017) [https://www.pubs.ext.vt.edu/content/dam/pubs\\_ext\\_vt.edu/ANR/ANR-279/ANR-279.pdf](https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt.edu/ANR/ANR-279/ANR-279.pdf)
- “Harvesting and Storage” (Michigan State University) [https://www.canr.msu.edu/chestnuts/harvest\\_storage/](https://www.canr.msu.edu/chestnuts/harvest_storage/)
- Asian Chestnut Gall Wasp (ACGW) in Kentucky (UK Entomology) <https://entomology.ca.uky.edu/entfact/asian-chestnut-gall-wasp-acgw-kentucky>
- Route 9 Cooperative <http://www.route9cooperative.com>

**Suggested Citation:**

Kaiser, C. and M. Ernst. (2020). *Chinese Chestnuts*. CCD-CP-66. Lexington, KY: Center for Crop Diversification, University of Kentucky College of Agriculture, Food and Environment. Available: <http://www.uky.edu/ccd/sites/www.uky.edu/ccd/files/chestnuts.pdf>

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**April 2020**

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## *Diospyros virginiana* (Common Persimmon) Ebony Family (Ebenaceae)

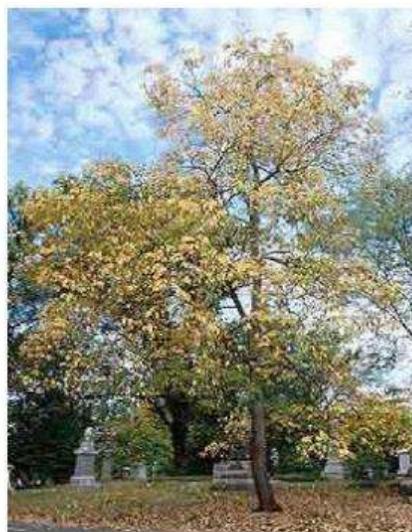
### **Introduction:**

Common persimmon has distinctive thick, dark gray to black bark that is broken into scaly, square blocks. Because of its messy fruit, it is not among the better choices for the home landscape, but is an interesting native tree that is suited for use in parks, golf courses and naturalized areas.

### **Culture:**

Common persimmon grows best in moist, well-drained, sandy soils but will perform well in dry soils with low fertility. It prefers full sun and adapts to a variety of pH situations. It is hardy in Zones 4 to 9.

This tree can develop a blackish leaf spot, although trees seem to vary considerably in susceptibility. In the South, it is susceptible to a vascular wilt. Tent caterpillars can also be a problem.



### **Additional information:**

Common persimmon was introduced into the landscape in 1629. It is often found along fence rows and in abandoned fields. The tree suckers profusely and often forms naturalized stands.

Before ripening, persimmon's fruit is not edible. The fruit is not ripe until the skin is wrinkled. Fruit presents a litter problem, and attracts flies and opossums as well as raccoons, skunks, foxes, deer and songbirds. The plant is dioecious, so a male (fruitless) tree would be a much more acceptable landscape plant than the female.

Immature fruits contain a large amount of tannin and are astringent. They have been used to make tea for use in gargling for sore throats. The tea was also used to treat warts, cancers, heartburn, diarrhea and stomach aches.

Ripe persimmons are said to taste a great deal like dates. They are used to make cakes, puddings and beverages. Native Americans used the fruits to make bread, and also dried them. Cooking oil, with a flavor like that of peanut oil, can be extracted from the seeds.

Confederate soldiers boiled persimmon seeds as a coffee substitute during the Civil War. Persimmon wood is very hard and nearly black. It is used to make golf club heads, billiard cues and parquet flooring.

*Diospyros* means "fruit or wheat of the gods;" *virginiana* means "from Virginia." One common name, possum wood, was given to the tree because opossums love its fruit.

### **Botanical Characteristics:**

Native habitat: Connecticut to Florida, and west to Texas and Kansas.

Growth habit: Slender, oval-rounded form; usually has a symmetrical outline.

Tree size: 35 to 60 feet tall, 20 to 35 feet wide.

Flower and fruit: Flowers are white to greenish white and are shaped like blueberry flowers. The tree blooms in late April. Fruit is a yellowish to pale orange berry that is 1 to 1½ inches across. Fruit, which is edible, ripens in September or October. It is delicious when ripe, but highly unpleasant before ripening.

Leaf: Alternate, simple leaves are 2 1/4 to 5½ inches long, and 3/4 to 2 inches wide. Leaves are dark green in summer but have little or no fall color other than occasional purple blotches.

Hardiness: Winter hardy to USDA Zone 4.

***Asimina triloba* (Pawpaw)**  
**Custard Apple Family (Annonaceae)**

**Introduction:**

Pawpaw, found from New York to Florida and west to Texas, has a semi-tropical appearance and is known for its fruit, the largest berry (up to 5 inches long) produced by any tree native to the United States. The fruit is nutritious and has been used in cancer therapy. Its twigs and bark contain a natural insecticide.

**Culture:**

Pawpaw prefers fertile, moist soil that is slightly acidic, and will sometimes tolerate wet soil. It can be grown in sun or shade, exhibiting dense growth in sun and open growth in shade. Pawpaw grows quickly if mulched and watered during droughts; it is drought-sensitive when grown in sun. Seedlings should be planted in shade for the first year as they are sensitive to ultraviolet light.

Pawpaw is pest-free and hardy in zones 5 through 8. It can be trained to grow with multiple trunks and its limbs are break-resistant. Some pruning is needed to create clearance because of drooping branches. Mowing or pruning the suckers that emerge from the root system encourages sprouting, so they should be hand-pulled while still small.

**Cultivars:**

There are at least 45 cultivars of pawpaw selected for their fruit characteristics. The national germplasm repository for pawpaw is at Kentucky State University in Frankfort, KY. Selected cultivars include:

- 'Convis' - Large (up to 1 pound) fruits with yellow flesh.
- 'Davis' - An older, popular plant from Michigan introduced in 1961. The fruit are less than ½-pound with yellow flesh.
- 'Overleese' - Heavy producing plant with clusters of 1-pound fruits. Selected in Indiana.
- 'Sunflower' - Produces 8-ounce fruit with a butter-yellow flesh. Said to be self-fertile. Selected in Kansas.
- 'Wells' - This cultivar has fruit with green skin and orange flesh. Fruit are a little less than a pound. Collected in Indiana.



**Botanical Characteristics:**

**Native habitat:** Northern Florida to Western New York, northern shores of Lake Ontario, Southern Michigan to Southwestern Iowa, and west to Southeastern Nebraska, and eastern parts of Kansas, Oklahoma and Texas.

**Growth habit:** Round, upright pyramid, with moderate density and coarse texture.

**Tree size:** 15 to 20 feet tall, 15 to 20 feet wide; can grow to 30 to 40 feet tall in ideal locations. Growth rate is moderate.

**Flower and fruit:** Flowers are nearly 2 inches across, pale green before turning brown, then maroon or purple. Pawpaw blooms in spring before leafout. Fruit is a 3- to 5-inch-long berry that is green when young then becomes dark and wrinkled when ripe in October or November. Ripe fruit has a flesh like custard and tastes a lot like bananas.

**Leaf:** Alternate, simple, 4 to 10 in+ches long and 4 to 6 inches wide. Light green, turning yellow in fall.

**Hardiness:** Winter hardy to USDA Zone 5.

## EASTERN WHITE PINE

*Pinus strobus* L.  
Plant Symbol = PIST

Contributed by: USDA NRCSS New York State Office



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USDA NRCSS 1995  
Northeast Wetland Flora  
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### Uses

**Timber:** The wood of white pine is light, durable, and easy to work. It is good lumber for toys, boxes, cabinet work, and similar items.

**Christmas tree and ornamental:** White pine is used occasionally in Christmas tree plantations and as ornamental planting in landscaping around homes and office buildings. It can also be sheared as a hedge.

**Wildlife:** It has fair wildlife value. Gray and red squirrels, deer, mice and 16 species of songbirds have been known to eat the seed.

**Erosion control:** White pine is frequently used for windbreaks and screens along fields new right-of-ways and around campsites.

### Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

### Description

*Pinus strobus* L., eastern white pine, is the largest conifer of the eastern and upper Midwest forests, reaching 150 feet in height and up to 40 inches in diameter. In dense stands, trees produce tall, cylindrical stems with pyramidal shaped crowns, characterized by distinctive, plate like branching, especially noticeable as the trees become older. On young growth, the bark remains rather thin, smooth, and greenish-brown in color. On older trees the bark becomes deeply fissured and dark grayish-brown in color. Its evergreen needles are in clusters of 5, soft, flexible, 2 1/2 to 5 inches long, and bluish-green in appearance. Its cones are about 4 to 8 inches long and 1 inch thick. These remain attached for 1 to several months after ripening in the autumn of the second season.

### Adaptation and Distribution

Eastern white pine grows on a variety of soils ranging from light, sandy to heavy textured soils. White pine ranges across southern Canada from Manitoba to Newfoundland, throughout the northern and eastern states from Minnesota and northern Iowa to the Atlantic coast, and southward along the Appalachian mountains to northern Georgia and Alabama.

For a current distribution map, please consult the Plant Profile page for this species on the PLANTS Website.

### Establishment

Seedlings of white pine are grown in nursery beds for field planting. They may either be left in the nursery for 2 to 3 years and directly planted into the field, or they may be transplanted after the second year and left in a transplant bed for 1 or 2 years before field plantings. This will produce a seedling approximately 12 to 16 inches in height with 1/4 to 1/2 inch caliper. Field establishment of seedlings is accomplished with tree planting procedures, using machine transplanters or hand planting.

Plant Materials <<http://plant-materials.nrcs.usda.gov/>>

Plant Fact Sheet/Guide Coordination Page <<http://plant-materials.nrcs.usda.gov/intranet/pfs.html>>

National Plant Data Center <<http://npdc.usda.gov/>>

## **Management**

White pine seedlings require weed control for the first few years after outplanting. Chemical and/or mechanical control can be used, preferably starting the year before planting.

Management of white pine should focus on thwarting the white pine weevil where straight trunks and tree form is desired. Growing white pine where there will be partial shade on the developing saplings and pole-sized trees (especially on the terminal leader) seems to reduce infestation by the weevil. Thus growing white pine in mixed uneven aged stands is a good idea to avoid this pest and those described below.

## **Pests and Potential Problems**

The white pine weevil is the tree's greatest insect pest affecting both timber quality and volume. Terminal leaders may be killed repeatedly and result in such serious stem crooks that the tree has reduced merchantable saw timber value.

The pales weevil is an insect that often attacks white pine seedlings in areas where white pine timber has been cut recently. Cone crops may be destroyed by the pine cone beetle. This insect compounds the problem of infrequent seed years and is a serious threat to white pine management.

Diseases, including white pine blister rust, red ring rot, root rot, wood decay, and certain needle fungi, cause losses in white pine stands. Such natural elements as snow, ice, and wind may also cause damage to white pine.

## **Cultivars, Improved, and Selected Materials (and area of origin)**

There are no documented varieties for reforestation purposes. Local or regional ecotypes are typically utilized for this purpose. There are several varieties available for ornamental applications. Seeds and seedlings are available from most eastern conifer nurseries.

## **Prepared By & Species Coordinator:**

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Edited: 05Feb2002 JLK; 060809 jsp

For more information about this and other plants, please contact your local NRCS field office or Conservation District, and visit the PLANTS Web site <<http://plants.usda.gov>> or the Plant Materials Program Web site <<http://Plant-Materials.nrcs.usda.gov>>

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