AMERICAN CHESTNUT

When the Europeans first landed upon America's shores, they found an abundance of trees that would soon fit many of their needs, such as timber, food, and medicine. Although most of those tree species had some type of use to them, some tree species were more useful to them than others. One tree species that the early settlers especially liked was the American Chestnut (*Castanea dentata* [Marshall] Borkhausen).

The American Chestnut is a member of the Beech Family (*Fagaceae*) and of the *Castaneoideae* Subfamily. The generic name, *Castanea*, is from the Greek name *Kastanea* or *Kastanon*, which is "Chestnut". The specific epithet, *dentata*, is from the Latin word *dentatus*, which is "toothed". A previous scientific name for this tree was *Castanea americana* (Michaux) Rafinesque. Other common names for this tree are American Sweet Chestnut, Chestnut, Common Chestnut, Edible Chestnut, and Sweet Chestnut.

The American Chestnut should not be confused with the Horsechestnut (*Aesculus hippocastanum* L.). The Horsechestnut, along with our own state tree, the Ohio Buckeye (*Aesculus glabra* Willdenow), is a member of the Buckeye Family (*Hippocastanaceae*). In Henry Wadsworth Longfellow's popular 1842 poem, *The Village Blacksmith*, the Chestnut Tree that was mentioned in the first line, *Under a spreading chestnut-tree*, was actually a Horsechestnut.

The American Chestnut was a fast-growing and a long-lived tree (up to 600 years). It was also shade-intolerant and was fire-resistant.

Uses of the American Chestnut

The American Chestnut was once a dominant tree in many parts of North America's Eastern Deciduous Forests. It was sometimes called "King of the Forest". Depending upon the specific location, the American Chestnut may have composed approximately 20-60% of the total trees within its area. Because of those high percentages, that tree was greatly utilized by the Native Americans, especially the Cherokee, the Iroquois, and the Mohegan (Mohican), and by the European settlers.

The early Europeans in American recorded Native Americans using this tree. In 1612, English Captain John Smith of the Jamestown Colony (present-day Virginia) recorded local tribes using this tree. In 1613, French Captain Samuel de Champlain of New France (present-day Canada) also recorded local tribes using this tree. Chestnuts have even been found in some Native American archaeological sites in Ohio and in other states.

Bark

The bark, the fruits, the leaves, and the wood all contain tannic acid (tannin). However, most of the tannin came from the bark. This tannin was used in the early leather tanning industry. In fact, over ½ of the tannin used in America came from the American Chestnut. The tannin was also used as a fungicide against some species of native fungi.

The bark had other uses as well. Some of the early settlers used the bark as roofing or as siding material for their log cabins. The bark was also used as a brown dye.

Leaves

The leaves were primarily used as medicine. A tea made from the leaves was used for treating coughs and colds. The tea was also used as a gargle for sore throats. A poultice made from the young spring leaves was used for treating burns, rheumatism, snakebites, sores, and swellings. The older dried leaves, which contained about 9% tannin, were gathered in the fall and were used as an astringent. These leaves' astringent and tonic properties were list in the *U. S. Pharmacopoeia* (1873-1905) and in the *National Formulary* (1916-1947).

Wood

The wood, which is softer than Oak (*Quercus*), was often used in construction. It was easily split and was used for making log cabins, barns, shingles, furniture (from cradles to coffins), musical instruments, barrels, interior paneling and trim, plywood, fence rails, fence posts, utility poles, ship masts, charcoal, and railroad crossties.

Because of its high tannin content (about 6-11%), this wood is both rot- and weather-resistant. It is highly durable in the air and in the soil.

This wood was even used in the pulp and paper industries. Because of the tannin in the wood, the wood chips needed to be boiled and the tannin leached out of the chips.

This wood also made good firewood. It burned hot and long and produced very little smoke, which made it ideal for moonshiners and for frontiersmen in hostile Indian country. However, the wood had to be seasoned before it would burn.

Even the cut stumps had their uses. Farmers used to uproot, upend, and align these stumps as fences. Building these fences required a lot of labor but they did last well over a generation. With their roots pointed upward, these stump fences must have been very unsightly. One historian claimed they resembled a "frozen witches' Sabbath".

Seednuts

The most valuable part of the American Chestnut was its seednuts, which the tree can produce after its 10^{th} year. These nuts were highly prized as a food. Almost every year this tree produced an abundance of chestnuts. Many of the early settlers allowed a few American Chestnuts to remain on their land so that they would have an abundant supply of these nuts. Every fall, after the first seasonal frost opens the husks, the local residents gathered these nuts by the bushels. These nuts were either stored over the winter or were sold as a commercial crop.

If they were stored for the winter, the nuts were usually dried in the Sun after they were gathered. This drying allowed the nut to produce more of its sugars, which made them sweeter. When they were stored, they were usually sprinkled with salt to keep any insect larvae from eating them.

The nuts that were sold provided the residents with a valuable source of barter or income. In some impoverished areas, these nuts became a valuable cash crop to the residents. Many of these chestnuts were sold in the cities to street vendors who roasted them and sold them on the streets.

These chestnuts are the sweetest tasting of all of the Chestnut species. They can be eaten raw, boiled, or roasted. They were sometimes used as a coffee or as a chocolate substitute. They can be ground into flour for making bread, cakes, or as a thickening agent. The chestnuts were listed in recipes in Martha Washington's *Booke of Cookery*.

The nuts are also highly nutritious. Each nut may contain about 11% protein, about 25% starch, about 15% sugar, and about 7% fat. The nut also contains vitamins B1, B2, C, polyunsaturated fat, and certain minerals, such as magnesium, phosphorus, potassium, and sulfur. Naturalist Ernest Thompson Seton had once said, *No Nut in our Woods to Compare with it as Food.*

Some farmers used the nuts to fatten their swine or other livestock. Swine fattened on Chestnuts usually had tastier meat than swine fattened on grain. However, this tastier meat could not be cured.

The nuts also had some medicinal uses. The grounded nuts were used as a poultice for treating toothaches.

Wildlife Uses

Many species of wildlife also liked this tree. The nuts were a favorite food of the White-tailed Deer (*Odocoileus virginianus* [Boddaert]), the Black Bear (*Ursus americanus* Pallas), the Northern Bobwhite (*Colinus virginianus* L.), the Ruffed Grouse (*Bonasa umbellus* L.), the Eastern Wild Turkey (*Meleagris gallopavo silvestris* Vieillot), the now-extinct Passenger Pigeon (*Ectopistes migratorius* L.), and several species of rodents (*Rodentia*). Some rodents buried the nuts, which helped spread this tree species. The White-tail Deer also browsed the twigs and the foliage.

The Chestnut Blight

Shortly after 1900, the American Chestnut trees were dying. The demise of the American Chestnut tree was caused by the Chestnut Blight fungus (*Cryphonectria parasitica* [Murrill] Barr) (Previous scientific names for this blight have been *Diaporthe parasitica* Murrill, until 1912, and *Endothia parasitica* [Murrill] Anderson & Anderson, until 1978.) This fungus produces spores that attack the tree. These spores land upon the tree's bark and enter the tree through wounds, cracks, insect or woodpecker holes, or any other openings in the bark. Once the spores reach the inner bark, they produce hair-like mycelia. The mycelia spread in a radial pattern through the cambium layers and even into the sapwood. These mycelia spread at a rate of 5-10 inches per year. This disease produces red, orange, or yellow, fast-growing, sunken cankers on the tree's trunk, limbs, and sprouts. Eventually, these cankers will penetrate deeper into the trunk, encircle the entire trunk, and then split or loosen the bark. These cankers will eventually girdle the trunk or the sprout. This girdling stops the transport of water and nutrients between the roots and the leaves. Eventually the tree starves and dies.

Meanwhile, the fungus seeps out of the bark and produces spore horns. These spore horns contain 2 types of spores. The first type of spore is a dry, large sexual spore, which is usually carried by the wind, sometimes for up to 1 mile. The second type of spore is a sticky, smaller asexual spore, which is carried by rain, birds, insects, or even by man. One spore horn can produce up to 5 million spores.

The Chestnut Blight in America

At the beginning of the 20th Century, the blight first hit the American Chestnut trees. The blight was first observed at New York's Bronx Zoo in 1904 when some groundskeepers noticed that their Chestnuts didn't look well. The city forester, Herman W. Merkel, could not identify the problem and had asked William A. Murrill, a

mycologist at the New York Botanical Garden, to look at these trees. Murrill and some other mycologists examined these trees and concluded that this disease was caused a newly arrived fungus. By 1906, the mycologists had identified and named this new fungus. They also determined that this fungus had arrived in New York's Botanical Garden before 1900 with a shipment of Asian Chestnut nursery seedlings. These imported seedlings were also infected by the fungus but were resistant to it.

Within a few years, all of the Chestnut trees at the Bronx Zoo had died. By then this blight had spread outside of New York City and into some neighboring states. This blight spread at a very rapid rate, sometimes up to 50 miles a year.

There were several unsuccessful attempts to stop the Chestnut Blight. In 1911, Congress appropriated $5000 to stop the blight. In 1912 and in 1913, Congress appropriated an additional $80,000 to stop the blight. In 1912, Pennsylvania appointed a statewide Chestnut Tree Blight Commission to deal with this blight. Then, in 1913-14, Pennsylvania appropriated $275,000 to stop this blight.

Several states had tried quarantine methods to stop the spread of this blight, including burning their infected trees or clearcutting large forested areas. At one point, Pennsylvania even attempted to cut a mile-wide swath across her entire state to halt the blight's spread. Other states also tried to cut wide swaths. None of these quarantine methods succeeded.

By 1950, approximately 3½-4 billion (over 99.99%) of the American Chestnuts were virtually eliminated from their natural range. This was probably the worst natural botanical disaster in recorded history.

Due to the tannin content in the wood, many of these dead trees remained standing for several years. Many people even said that the dead trees resembled ghosts in the woods. Fortunately, much of the wood in those trees was still salvageable and many of those trees were harvested for their wood.

Although the American Chestnut was eliminated from its natural range, there were some trees that survived because they had been previously planted far outside of their natural range and out of the range of the blight. Most of these trees were planted in remote areas of the Upper Midwest, such as Wisconsin, in the Far West, such as California and Oregon, and in parts of Canada.

As destructive as this blight was to the Chestnut trees, it did not kill their roots or their root collars. The blight fungi cannot survive in the soil because the fungi and the bacteria in the soil attack the blight fungi. Many of these roots and stumps are still able to send up sprouts. These sprouts form dense coppices, sometimes as many as 300 sprouts. If not browsed by the White-tailed Deer, these sprouts will produce leaves. After about 5 years, these sprouts may even produce a few crops of nuts. Unfortunately, after about a decade or so, these sprouts also get the blight and die. Fortunately, new sprouts will replace the dead ones. These new sprouts will also produce new roots to extend the tree's lifespan.

Most of the stumps that send up the sprouts were not the dominant trees in the forest because most of their roots are long dead. The stumps that do send up the sprouts are from the understory trees. After the dominant trees had died, these non-dominant stumps began receiving more sunlight and were able to send up their sprouts. Eventually, those roots will die, too.

The Chestnut's Return

Despite the devastation from the Chestnut Blight, efforts are being made to restore the American Chestnut tree. Two major private, non-profit organizations, The American Chestnut Foundation (TACF) and the American Chestnut Cooperators' Foundation (ACCF), are both dedicated to restoring the American Chestnut.

The American Chestnut Foundation

The American Chestnut Foundation was founded in 1983. It is headquartered in Bennington, Vermont, and owns a large tree nursery in Meadowview, Virginia. Their goal is to crossbreed the American Chestnut with Asian chestnuts, which have some resistance to the blight. The 2 main Asian species are the Chinese Chestnut (*Castanea mollissima* Blume) and the Japanese Chestnut (*Castanea crenata* Siebold & Zuccarini).

Under this program, an American Chestnut is initially crossbred with the Chinese Chestnut, which is the most resistant of all Chestnuts. This American x Chinese hybrid, which is ½ American Chestnut, is then backcrossed with the American Chestnut for 3 more generations. Each succeeding generation will leave the new offspring with 50% more of the American Chestnut trait than the parent generation. Eventually, the new tree will be 15/16 American Chestnut and 1/16 Asian Chestnut. Hopefully, these new progeny will have enough of the physical features of the American Chestnut but with the resistant genes of the Chinese Chestnuts. However, it will take about 30-50 years to complete all of these generations.

Previous attempts had been made to crossbreed Chestnut species. In 1922, the USDA started it and, in 1930, both the Brooklyn Botanical Garden and the Connecticut Agriculture Experimental Station attempted it.

Unfortunately, this crossbreeding method has not always been 100% successful. Many of these hybrids had succumbed to the blight. Other hybrids had yielded trees with poor forms or slow growth rates.

The American Chestnut Cooperators' Foundation

The American Chestnut Cooperators' Foundation was founded in 1984 and is headquartered in Newport, Virginia. Their integrated management program uses only American Chestnuts and combines 2 methods.

The first method involves crossbreeding or grafting resistant American Chestnuts with other American Chestnuts to produce offspring trees with even more resistance. Although this program has had some success, the offspring trees sometimes produce sterile seednuts.

The second method is to inoculate the cankers of those resistant trees with a hypovirulent strain of that fungus. This new strain, which had been infected with a virus that weakens the lethal strain, is hardier than the lethal strain and will attack and even kill the lethal strain.

This new strain weakens the effects of the blight by producing white, slow-glowing, swollen cankers. These swollen cankers are only superficial and would only be confined to the outer part of the tree. This will allow the tree to heal itself.

The Italian plant pathologist, Antonio Biraghi, first discovered this hypovirulent strain in the 1950's. He discovered it in the European Chestnut (*Castanea sativa* Miller). During the 1960's, a French agronomist, Jean Grente, studied this hypovirulent strain.

While this hypovirulent strain works effectively in the European Chestnut trees, it doesn't work as effectively in all of the American Chestnut trees. The hypovirulent strain does not spread in nature as rapidly as does the lethal strain. Also, the hypovirulent strain can mutate back into the lethal strain or can produce offspring strains that are lethal. This hypovirulent strain is still being researched in the Connecticut Agriculture Experimental Station and in several other locations in the eastern United States.

Other methods

Other methods are being used to fight the Chestnut blight. Some are more effective than others.

Attempts have been made to mutate the chestnuts with chemicals or ionized radiation. It is hoped that these mutated chestnuts would produce trees that are resistant to the blight.

Another attempt is to rub soil, which contains those anti- blight bacteria and fungi, onto the cankers. Although the soil's organisms attack the blight fungi, this method is not practical on a large scale.

Still another attempt is to introduce genes from certain snail species into the American Chestnut. These snails produce proteins that kill the Chestnut Blight fungus spores.

In 1930, Poet Robert Frost wrote about the Chestnut Blight in his prophetic poem, *Evil Tendencies Cancel*.

Will the blight end the chestnut?
The farmers rather guess not.
It keeps smoldering at the roots
And sending up new shoots
Till another parasite
Shall come to end the blight.

All of these methods will take several years to produce the desired results. By using all of the above methods, perhaps someday the American Chestnut tree will return to its rightful place in America.

DESCRIPTION OF THE AMERICAN CHESTNUT

Height: Originally about 40-130 feet. On some of the tree trunks, there were no branches for at least 50 feet. Stump sprouts may reach a height of about 30 feet.
Diameter: 2-8 feet. (In 1880, one tree in Seymour, Indiana, measured 22 feet in diameter.) The stump sprouts may reach a diameter of about 12 inches.
Crown: The crown is broad, dense, rounded, spreading, and wide. In open areas, the crown may reach 100 feet in diameter.
Bark: Dark gray-brown. The young bark is smooth. The old bark is thicker and is furrowed with many broad flat glossy ridges. The ridges may appear to spiral around the tree's trunk.
Twigs: The twigs are dark brown, are yellow-green with a red tinge, or are olive-green with a yellow tinge. Each twig is stout, hairless, lenticellate, glossy, and zig-zag. Its pith is white, continuous, and has a 5-pointed, star-shaped cross-section.

Buds: Gray to yellow-, green- or dark brown, blunt, hairless, and glossy. Each bud is ovate or ovoid, is about 1/8-1/4 inch long, is obliquely sessile, and has about 2-3 smooth imbricate scales. These buds are usually arranged in 2 or more rows. Although most of the buds are clustered near the tip of the twig, there are no true terminal buds.
Leaves: The leaves are simple, alternate, and deciduous. Each leaf is about 4-11 inches long, about 1½-3 inches wide, is elongated, lanceolate, and oblong, has 1 central midvein and numerous straight and parallel side veins (about 15-20 veins per side), and has a long pointed tip and a narrow acute base. Its margins are coarsely and sharply toothed with a bristled or a spined tip. Its petiole is short, stout, and hairy. The leaf is hairless, smooth, leathery, glossy, yellow- or dark green above, and pale green below. These leaves usually turn yellow in the fall.
Leaf Scars: The leaf scars are semi-oval, raised, and have 3 or more scattered bundle scars.
Flowers: There are both male and female flowers on this tree. These flowers cannot self-pollinate. Both sexes are clustered in semi-erect stalks. These flowers are aromatic and are both wind- and insect-pollinated. Depending upon latitude and altitude, flowering season is usually April to August, which is after the damaging frosts and is later than other mast-producing trees.

Male Flowers: The staminate (male) flowers are creamy white to yellow-green and are arranged in 6-12 inch long upright catkins. These catkins are located in the leaf axils. Each flower is about 3/16 inch long. Because of the large abundance of these white flowers in the spring, many people said these flowers resembled snow from a distance.

Female Flowers: The pistillate (female) flowers are usually arranged in groups of 1-3 and are less conspicuous than the male flowers. They are located at the base of some of the smaller male catkins or in the leaf axils. Each flower is about 3/8 inch long and is bordered by narrow green scales.
Fruit: Husk. Each husk is globose or spherical, is about 2-3 inches in diameter, is short-stalked, silky or velvety on the inside, and is densely covered on the outside with stiff and prickly burs. The husk is green when young but will later turn red-brown. Each bur (or spine) is about ½ inch long, glossy, and branched. The entire husk is surrounded by a leathery involucre. When ripe, these husks open along 3-4 lines to expel their 2-3 nuts. The husks will shortly drop after all of the nuts are expelled.

Each nut is about ½-1 inch diameter, is broadly ovate, is pointed and flattened on 1-2 sides, is thin-shelled, and is shiny and dark brown. The tree is usually able to produce abundant nut crops annually. Fruiting season is usually August to November.
Roots: The tree has a deep prominent taproot. These roots are prolific sprouters. Because of their sprouting, this tree was once considered to be a weed tree.
Wood: The heartwood is red-brown and its sapwood is much lighter. This wood is straight- and coarse-grained, light, soft, and weak.
Habitat: Mainly found on wooded or rocky slopes or on dry ridges. It tolerates a variety of soils, including well- drained, acidic, or sterile soils, in Mixed Mesophytic forests. The tree tolerates cold winters but prefers climates with warm summers.
Range: Appalachian Mountains and Ohio River valley, from New England to the Deep South to the Mississippi River.

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