Carya laciniosa (Michx. f.) Loud. Shellbark Hickory

Juglandaceae Walnut family

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Shellbark hickory *(Carya laciniosa)* is also called shagbark hickory, bigleaf shagbark hickory, kingnut, big shellbark, bottom shellbark, thick shellbark, and western shellbark, attesting to some of its characteristics. It is a slow-growing long-lived tree, hard to transplant because of its long taproot, and subject to insect damage. The nuts, largest of all hickory nuts, are sweet and edible. Wildlife and people harvest most of them; those remaining produce seedling trees readily. The wood is hard, heavy, strong, and very flexible, making it a favored wood for tool handles. A specimen tree has been reported in Missouri with 117 cm (46.2 in) in d.b.h., 36.9 m (121 ft) tall, and a spread of 22.6 m (74 ft).

Habitat

Native Range

Shellbark hickory (figs. 1,2) is widely distributed but is nowhere common. The range extends from western New York through southern Michigan to

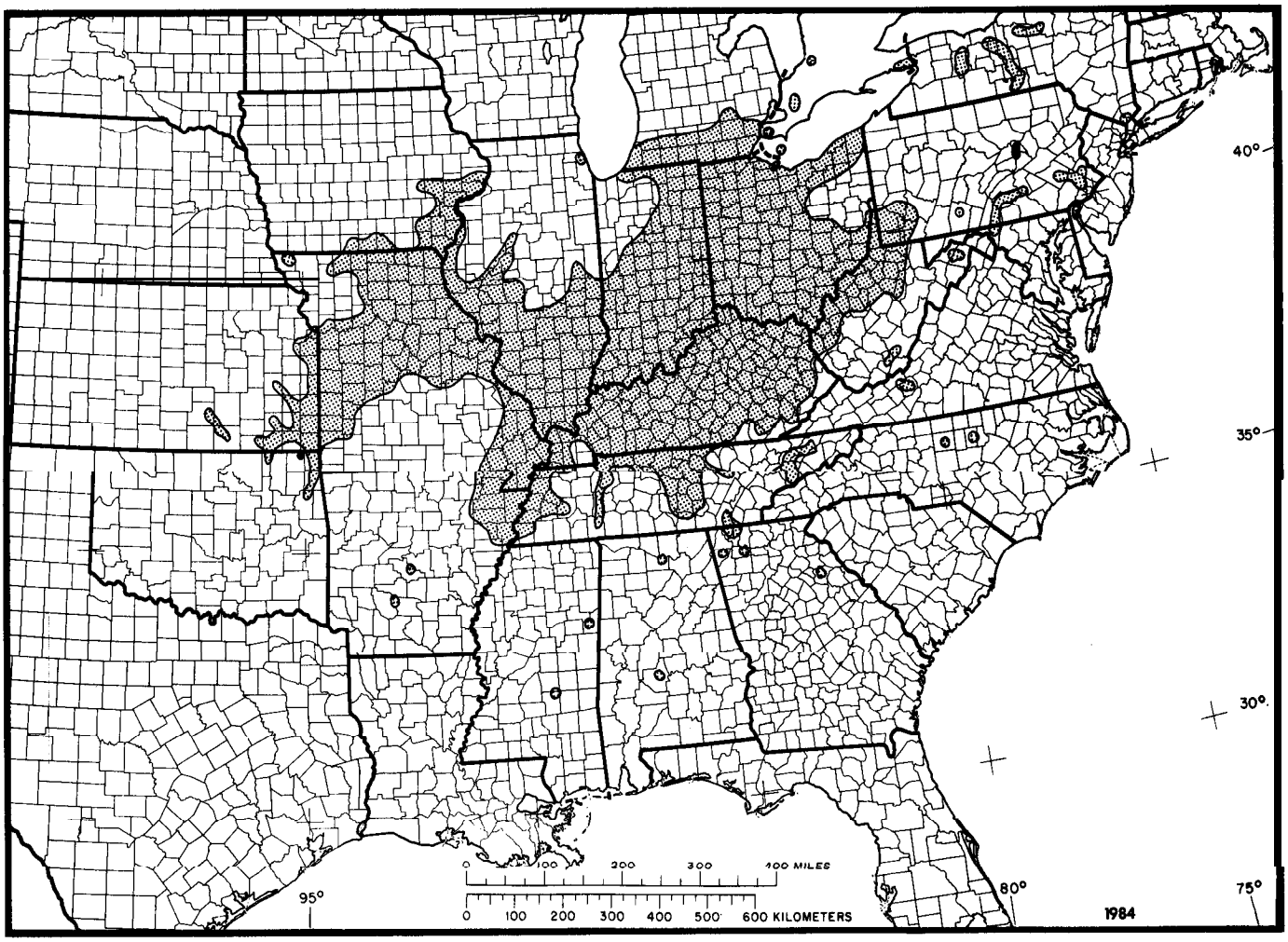

Figure *1-The native range of shellbark hickory.*

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Figure 2—*Shellbark hickory.*

southeast Iowa, south through eastern Kansas into northern Oklahoma, and eastward through Tennessee into Pennsylvania. This species is most prominent in the lower Ohio River region and south along the Mississippi River to central Arkansas. It is frequently found in the great river swamps of central Missouri and the Wabash River region in Indiana and Ohio (5).

Climate

The mean length of the frost-free period within the range of shellbark hickory is from 150 to 210 days. The average January temperature is between –4° and 5" C (25" and 41" F), and for July the mean temperature is from 23" to 27" C (73° to 81" F). An average minimum temperature of -26" C (-15" F) occurs in the northern part of the range, and an average maximum temperature of 38" C (100" F) is found throughout the range. Precipitation varies between 750 and 1500 mm (30 and 59 in) per year including 15 to 90 cm (6 to 35 in) of snow (7).

Soils and Topography

Shellbark hickory grows best on deep, fertile, moist soils, most typical of the order Alfisols. It does not thrive in heavy clay soils but grows well on heavy loams or silt loams. Shellbark hickory requires moister situations than do pignut, mockernut, or shagbark hickories *(Carya glabra, C. tomentosa,* or *C. ovata)*, although it is sometimes found on dry, sandy soils. Specific nutrient requirements are not known, but generally the hickories grow best on neutral or slightly alkaline soils.

The species is essentially a bottom-land species and is often found on river terraces and second bottoms. Land that is subject to shallow inundations for a few weeks early in the growing season is favorable for shellbark. However, the tree will grow on a wide range of topographic and physiographic sites (7).

Associated Forest Cover

Shellbark hickory may be found in pure groups of several trees but is more frequent singly in association with other hardwoods. The species is a minor component of the forest cover types Bur Oak (Society of American Foresters Type 42), Pin Oak-Sweetgum (Type 65), and Swamp Chestnut Oak-Cherrybark Oak (Type 91). It may also be found in one or more of the types in which hickories are included, but it is not identified at the species level (3).

Shellbark hickory commonly grows in association with American *(Ulmus americana),* slippery (U. *rubra),* and winged elms *(U. alata)*, white *(Fraxinus americana)* and green ash *(F. pennsylvanica)*, basswood *(Tilia americana),* American hornbeam *(Carpinus caroliniana),* red maple *(Acer rubrum)*, blackgum *(Nyssa sylvatica),* sweetgum *(Liquidambar styraciflua),* and cottonwood *(Populus deltoides).* It is found in association with four other hickories-shagbark, mockernut, bitternut *(Carya cordiformis)*, and water (C. *aquatica),* and numerous oak species, including swamp white *(Quercus bicolor)*, pin (Q. *palustris)*, white *(Q. alba)*, Shumard *(Q. shumardii),* water *(Q. nigra),* Delta post *(Q. stellata* var. *paludosa),* swamp chestnut *(Q. michauxii),* and Nuttall *(Q. nuttallii).*

The herbaceous stratum includes numerous sedges and grasses. The shrub and small tree layer may be composed of painted buckeye *(Aesculus sylvatica),* pawpaw *(Asimina triloba),* flowering dogwood *(Cornus florida)*, eastern redbud *(Cercis canadensis),* possumhaw *(Ilex decidua),* poison-ivy *(Toxicodendron radicans)*, and trumpet-creeper *(Campsis radicans).*

Life History

Reproduction and Early Growth

Flowering and Fruiting-Shellbark hickory is monoecious, producing flowers from April to June after the leaves appear. The male flowers develop from the axils of leaves of the previous season or from inner scales of the terminal buds at the base of the current growth. The female flowers appear in short spikes or peduncles terminating in shoots of the current year. The pollen is wind disseminated. The fruit ripens from September to November (2).

Seed Production and Dissemination— Shellbark nuts are the largest produced by any hickory. The number of cleaned seed per kilogram ranges from 55 to 75 (25 to 35/lb). Hickories show embryo dormancy. Shellbark hickory seeds require from 90 to 120 days of cold stratification before they will germinate. The minimum tree age for seed production is about 40 years, with the most seed produced between 75 and 200 years. Thrifty trees may produce 70 to 105 liters (2 to 3 bu) of nuts in a good year, and good crops are produced about every second year (2).

The seed is dispersed from September to December by gravity, birds, and animals. Squirrels and other rodents are the principal dispersal agents (7).

Seedling Development-Shellbark hickory requires moist soil for good germination and establishment. Germination is hypogeal. Seeds germinate from late April to early June. The seedlings rapidly develop a long taproot, but shoot growth is initially slow. Shellbark hickory seedlings grow faster in height than most of the other hickories (7).

Shellbark hickory is shade tolerant in early life and reproduces under forest conditions. Under light shade height growth may be slow. In the Ohio Valley, seedlings were only 11 cm (4 in) tall after 1 year and 56 cm (22 in) tall at the end of 5 years.

Vegetative Reproduction-Shellbark hickory sprouts readily when cut, and coppice management has been recommended for this and other hickories. It is a persistent sprouter following fire and/or grazing. Although more difficult to propagate by grafting and budding than fruit trees, this species can be reproduced by these techniques with good success. It is not known whether shellbark hickory will root from cuttings.

Sapling and Pole Stages to Maturity

Growth and Yield-The hickories as a group grow slowly in diameter, and shellbark hickory is no exception. Sapling size trees average 2 mm (0.08 in) per year in diameter growth, increasing to 3 mm (0.12 in) per year as poles and sawtimber. Second-growth trees show growth rates of 5 mm (0.20 in) per year. Shellbark hickory occasionally grows to a height of 40 m (131 ft) and a diameter of 100 cm (39 in) (7).

Rooting Habit-Shellbark hickory develops a large taproot that penetrates deeply into the soil. Lateral roots emerge at nearly right angles to the taproot, spreading horizontally through the soil. No distinct major lateral roots develop. In Illinois, root growth was rapid in April, slowed during July and August, increased again in September, and ended in late November (7).

Mycorrhizal associations are formed when trees are young. The only specific fungus identified from shellbark hickory roots is an ectotrophic mycqrrhiza, ***Laccaria ochropurpurea (8).***

Reaction to Competition-Shellbark hickory is very shade tolerant, exceeded only by sugar maple *(Acer **saccharum**)* and beech *(Fagus **grandifolia**).* It grows slowly under a dense canopy, however. In stands with only partial shade, it reproduces well. It is a very strong competitor in most of the species associations in which it is found.

Under forest conditions, shellbark hickory often develops a clear bole for half its length and has a narrow, oblong crown. Open-grown trees have egg-shaped crowns (7). Heavy release sometimes results in epicormic branching.

Damaging Agents-Although numerous insects and diseases affect hickories, shellbark hickory has no enemies that seriously threaten its development or perpetuation as a species. Seed production can be reduced significantly, however, through attack by several insects. Two of the most important are the pecan weevil ***(Curculio caryae)*** and the hickory shuckworm ***(Laspeyresia caryana)*** .

The hickory bark beetle ***(Scolytus quadrispinosus)*** feeds in the cambium and seriously weakens or even kills some trees. Adults of the hickory spiral borer *(Agrilus **arcuatus torquatus**)* feed on leaves, but the larvae feed beneath the bark and can be very destructive to hickory seedlings. The flatheaded appletree borer ***(Chrysobothris femorata)*** likewise is a foliage feeder as an adult, but its larvae feed on the phloem and outer sapwood.

The living-hickory borer (Goes *pulcher)* feeds in the trunks and branches of trees. A twig girdler *(Oncideres cingulata)* can seriously affect reproduction by killing back the tops of seedlings and sprouts. Both standing dead trees and freshly cut logs are highly susceptible to attacks by numerous species of wood borers.

A large number of insect species feed on hickory foliage. None of them cause serious problems for shellbark hickory, although they may be responsible for some stem deformity and growth loss *(1).*

Shellbark hickory is free of serious diseases, but it is a host species for a variety of fungi. More than 130 fungi have been identified from species of ***Carya.*** These include leaf disease, stem canker, wood rot, and root rot-causing fungi. Specific information for shellbark hickory is not available (4).

Shellbark hickory is susceptible to bole injury from fire, and fire injuries are often invaded by wood rot fungi. It is resistant to snow and ice damage but is susceptible to frost damage.

Special Uses

Shellbark hickory nuts are used for food by ducks, quail, wild turkeys, squirrels, chipmunks, deer, foxes, raccoons, and white-footed mice. A few plantations of shellbark hickory have been established 'for nut production, but the nuts are difficult to crack even though the kernel is sweet. The wood is used for furniture, tool handles, sporting goods, veneer, fuelwood, and charcoal.

Genetics

Shellbark hickory hybridizes with pecan, ***Carya illinoensis*** *(C. x nussbaumeri* Sarg.), and shagbark hickory, ***C. ouata*** *(C. x dunbarii* Sarg.). Shellbark hickory has 32 chromosomes. In general, species within the genus with the same chromosome number are able to cross. Numerous hybrids among the Carya species with 32 chromosomes (pecan, bitternut, shellbark, and shagbark) have been described *(5,6).*

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