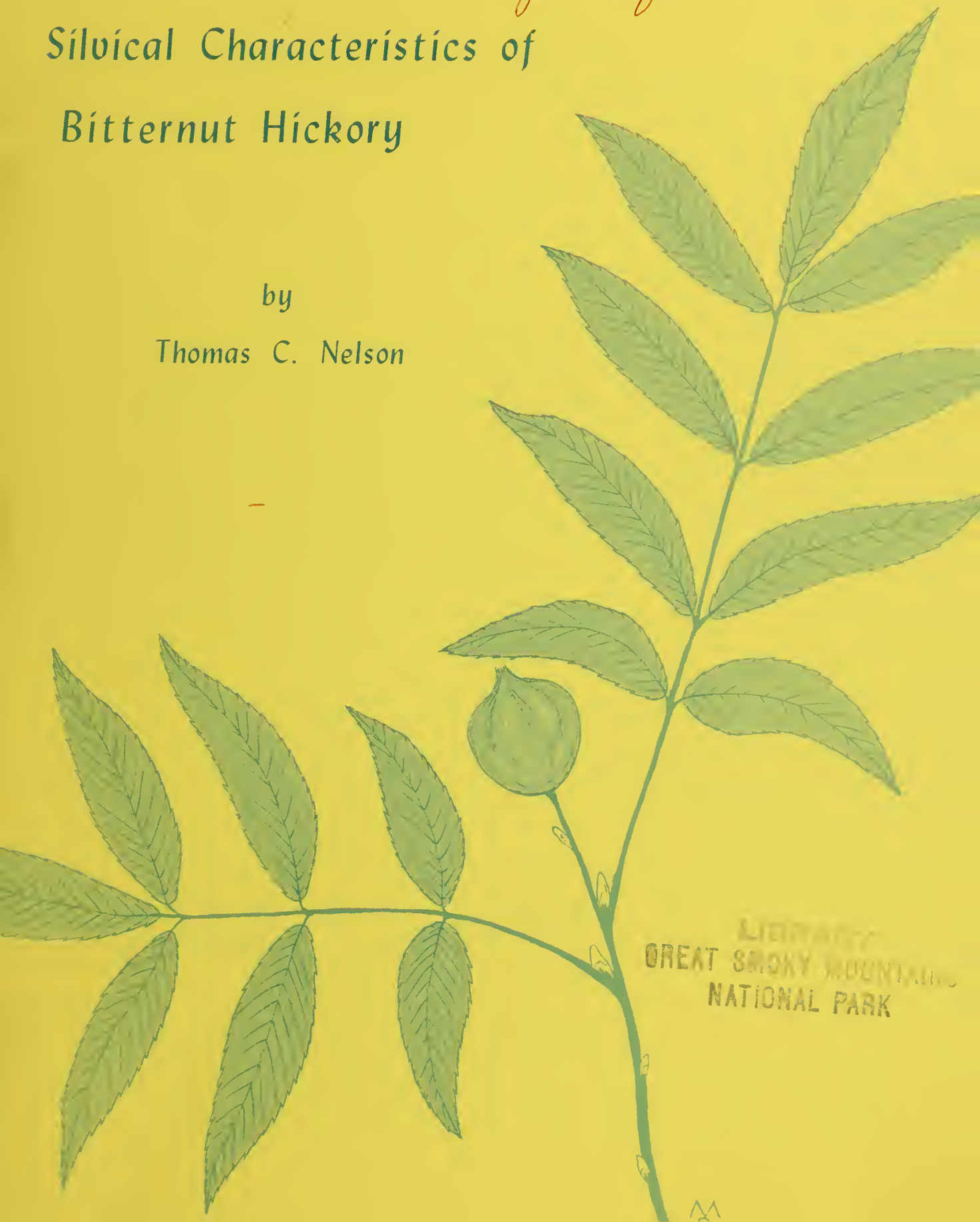


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by
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Silvical Characteristics of Bitternut Hickory

(Carya cordiformis (Wangenh.) K. Koch)

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Bitternut hickory (Carya cordiformis (Wangenh.) K. Koch), sometimes called swamp hickory or pignut (10), is the only member of the pecan group (Apocarya) common to the northeastern United States and is probably the most abundant and uniformly distributed of the hickories. It is found in all of the eastern United States, except the northern parts of Michigan and Wisconsin, and on the South Atlantic and Gulf Coastal Plains (7) (fig. 1). It is common from southern New England west to Iowa and from southern Michigan south to Kentucky (4). Its range extends farther west than any other hickory species except shagbark (5) and farther north than other hickories. Bitternut hickory, marketed as "pecan," finds use in tool and implement handles and flooring. The lower grades are used in pallets (18).

HABITAT CONDITIONS

CLIMATE

Bitternut hickory grows in a climate classified as humid (16). Generally, the mean annual precipitation varies from 25 to 50 inches within the range of the species, except for a small area in the Southern Appalachians where 80 inches is not uncommon. In the northern portion of the species range, snowfall averages 80 inches per year; at the southern extreme of the range, it rarely snows (9).

Average annual temperatures range from 40° to 55° F.; average July temperatures from 56° to 80°; and average January temperatures from 15° to 50°. Extremes of 115° and -40° have been recorded within the range. Bitternut is seldom found in areas with less than 120 days or more than 240 days of average growing season (9).

EDAPHIC AND PHYSIOGRAPHIC

The habitat of bitternut hickory varies with relation to the portion of its range under consideration. In the northern part of its range, bitternut hickory occurs on a variety of sites. Otis (11), in describing its habitat in Michigan, states that the species "prefers a rich, loamy or gravelly soil; low wet woods; along the borders of streams; but also found on high, dry uplands."



Figure 1. -- Botanical range of bitternut hickory.

In the southern portion of its range, bitternut is more restricted to moist sites than in the northern part. It reaches its largest size on the rich bottom lands of the lower Ohio basin (13). In the southeastern portion of its range, it occurs only on overflow bottoms (3) (fig. 2). However, in the southwestern part of its range, bitternut is common on the poor, dry, gravelly soil of the uplands (13).

Bitternut is absent from the mountain forests of northern New England and New York (13), and is not found at the higher elevations in the Appalachians.

BIOTIC

Bitternut hickory is a major component of two forest cover types and is a secondary species in another. In the northern part of the white oak-red oak-hickory type (type 52), bitternut is often the hickory species which forms this type in combination with various oaks. In the South, bitternut is often a prominent species in the swamp chestnut oak-cherrybark oak type (type 91). Bitternut hickory, black oak (Quercus velutina), northern red oak (Quercus rubra), bur oak (Quercus macrocarpa), shagbark hickory (Carya ovata), white ash (Fraxinus americana), bigtooth aspen (Populus grandidentata), and yellow-poplar (Liriodendron tulipifera) are associates in the white oak type (type 53). The forest types in which bitternut hickory is a major component are climax or permanent types.

Because it occupies various site conditions throughout its geographical range, its associates are varied. An example of its associates in the northern portion of its range is given by Gordon (6). In northern Indiana, principal associates in the upland oak forest include white oak (Quercus alba), red oak, black oak, shingle oak (Quercus imbricaria), shagbark hickory, and pignut hickory (Carya glabra). Secondary associates are red maple (Acer rubrum), black cherry (Prunus serotina), and sassafras (Sassafras albidum). Bitternut is a minor associate of the "mixed mesophytic" forest of that region. However, it is conspicuously absent in the description of species on the poorly drained and bottom land sites of northern Indiana.

Braun (5) quotes Akerman on the associates of bitternut hickory in eastern Virginia. On the ravine slopes and the slopes from the uplands to the stream beds, bitternut hickory is associated with beech (Fagus grandifolia), yellow-poplar, elm (Ulmus spp.), sycamore (Platanus occidentalis), sweetgum (Liquidambar styraciflua), white oak, red maple, black walnut (Juglans nigra), and butternut (Juglans cinerea).

In the southern bottom land hardwoods, bitternut is associated with swamp chestnut oak, cherrybark oak (Quercus falcata var. pagodaefolia), white ash, shagbark hickory, shellbark hickory (Carya laciniosa), mockernut hickory (Carya tomentosa), white oak, Delta post oak (Quercus stellata var. mississippiensis), Shumard oak (Quercus shumardii), and black gum (Nyssa sylvatica). Sweetgum may occasionally be of high importance in association with bitternut. Minor associates include willow oak (Quercus phellos), southern red oak (Quercus falcata), post oak (Quercus stellata), American elm



Figure 2.--Forest-grown bitternut hickory, Oglethorpe County, Georgia. This tree, standing in the Oconee River bottom lands, is approximately 45 years old, 103 feet tall, and 20 inches d. b. h.

(Ulmus americana), winged elm (Ulmus alata), swamp hickory (Carya leioder-mis), nutmeg hickory (Carya myristicaeformis), southern magnolia (Magnolia grandiflora), yellow-poplar, and American beech (Fagus grandifolia) (14).

LIFE HISTORY

SEEDING HABITS

Flowering and fruiting. -- The male and female flowers are borne in separate flowers on the same plant (monoecious). Catkins of male flowers are from 3 to 4 inches long, and are usually produced on branches of the previous year. Female flowers are $\frac{1}{2}$ -inch in length and covered with yellow, dense pubescence (13).

Depending upon latitude and weather, the flowers bloom in April or May; the fruit ripen in September and October, and are dispersed from September through December (17) (fig. 3).

Seed production. -- Bitternut hickory does not produce seed until the tree is approximately 30 years of age. Optimum seed production extends from 50 to 125 years. Trees over 175 years seldom produce good seed crops (17).

Good seed crops appear at 3- to 5-year intervals. Light seed crops are borne in the intervening years (17). Bitternut hickory seed is estimated to be from 70 to 85 percent viable (15).

Seed dissemination. -- Seed dissemination is almost entirely by gravity, since the fruit is claimed to be generally distasteful to wildlife (19).

VEGETATIVE REPRODUCTION

Boisen and Newlin (4) state that bitternut hickory is the best sprouter of the northern species of hickory. The average height of dominant 1-year-old sprouts was 4.7 feet. Sprouts may grow from the stump, the root collar, and the root. Most of the sprouts from sapling and pole-size trees are root collar sprouts, and those from sawtimber-size trees are mostly root suckers. Sprouts from the stumps are usually less numerous than either root collar sprouts or root suckers.

SEEDLING DEVELOPMENT

Establishment. -- Hickories, in general, require a moderately moist seed-bed (20) for satisfactory seed germination. Bitternut probably can tolerate a more moist seedbed than most of the other species. It is one of the hickories least susceptible to frost (4).

Early growth. -- No information is available on early seedling growth; however, Boisen and Newlin (4) reported the average bitternut on red clay soil had an 11-inch taproot at the age of 1 year.



Figure 3. --Typical bark, twig and bud, leaves, and fruit of bitternut hickory.

SAPLING STAGE TO MATURITY

Growth and yield. -- Second-growth bitternut hickory on a good site in the Ohio Valley reaches the following average heights and diameters (4).

<u>Age</u> (Years)	<u>Height</u> (Feet)	<u>D. b. h.</u> (Inches)
10	10	2.0
20	24	4.0
30	40	6.0
40	52	7.6
50	62	9.2
60	69	11.4
70	--	13.0

Bitternut has a tendency to prune itself more readily than the other hickories. The proportion of sapwood to heartwood is characteristically low; sapwood is seldom over $1\frac{1}{2}$ inches wide or more than 25 years old (4).

Reaction to competition. -- The hickories, in general, were classified as intolerant by Baker (1), although bitternut seems to have a higher seedling tolerance on overflow bottoms than most of its associates.

Principal enemies. -- When young, bitternut hickory is very easily damaged by fire (19), and is susceptible to fire-damage at all ages. Although bitternut probably is host to a number of stem and root rots, none are known to be particularly damaging. However, like all hardwoods, a number of heart-rot fungi will cause progressive decay after they gain entry through wounds, particularly those wounds caused by fire. It is host to several leaf and twig fungi: anthracnose (Gnomonia caryae), witches'-broom (Microstroma juglandis), and scab (Cladosporium effusum).

Bitternut hickory is attacked by the hickory bark beetles (Scolytus quadrispinosus), especially in drought years. Ambrosia beetles (Platypus compositus) are common on logs (2). Younger trees are attacked by the hickory twig girdlers, Oncideres cingulatus, Oncideres texanus, and Oncideres pustulatus (8).

RACES AND HYBRIDS

There is no evidence thus far to show the existence of geographic races in bitternut hickory.

Three naturally occurring hybrids of bitternut hickory are recognized: Carya X brownii Sarg. (Carya cordiformis X illinoensis); Carya X demareei Palmer (Carya cordiformis X glabra); and Carya X laneyi Sarg. (Carya cordiformis X ovata) (9, 12).

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