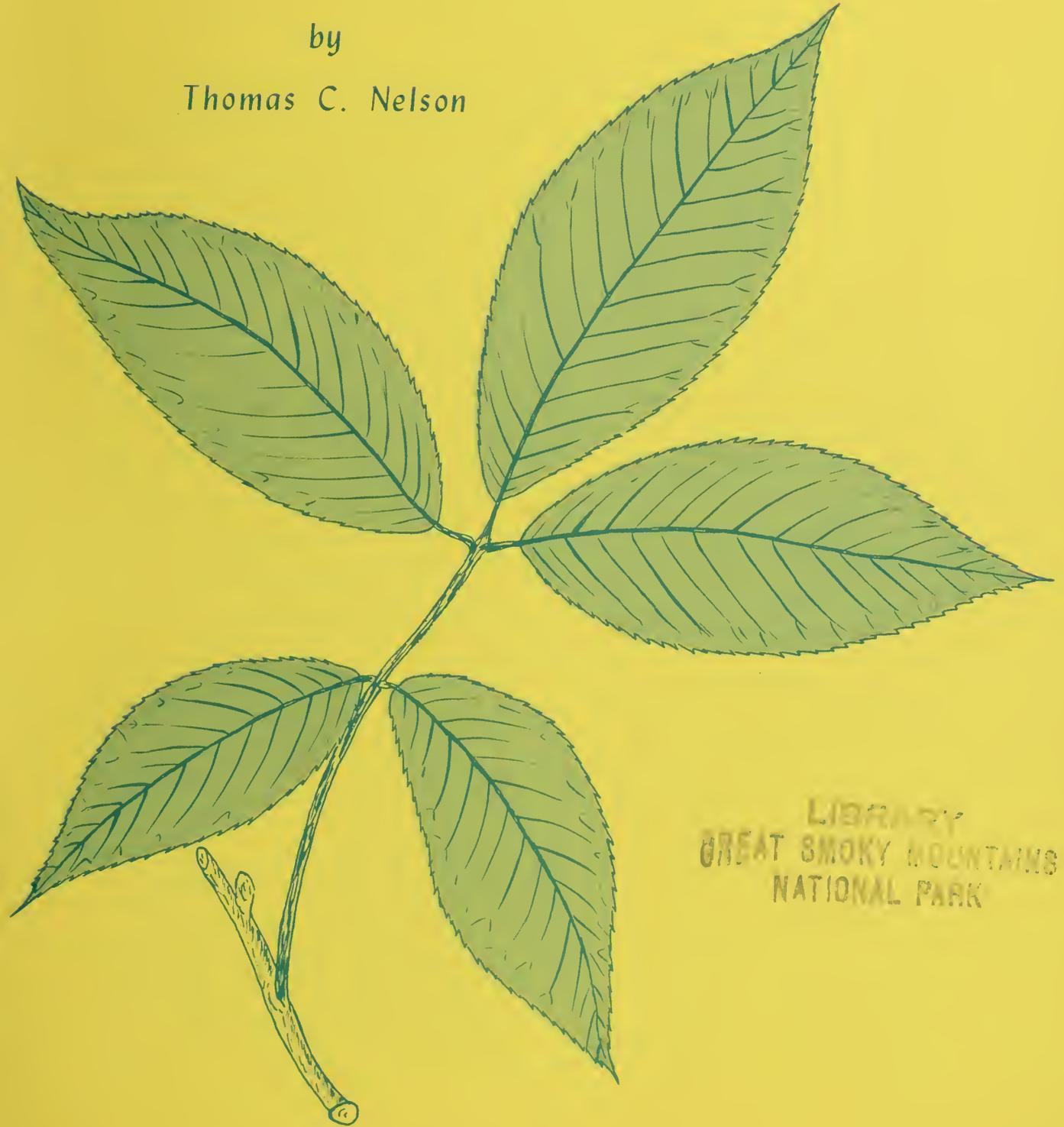


Carya ovata - 44

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by
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Silvical Characteristics of Shagbark Hickory

(Carya ovata (Mill.) K. Koch)

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Thomas C. Nelson

Of all the hickories, shagbark (Carya ovata (Mill.) K. Koch) is probably the most distinctive in appearance because of its loose plates of bark. Common names include scalybark hickory, shellbark hickory, upland hickory, and shagbark. This species, as with most hickory species, loses its identity in the lumber market, and is sold as "hickory" (10). Shagbark is evenly distributed over a wide range, and together with pignut hickory furnishes the bulk of commercial hickory. The botanical range is shown in figure 1.

HABITAT CONDITIONS

CLIMATIC

Shagbark hickory grows in a humid climate, according to Thornthwaite's classification (15). Mean annual precipitation varies from 30 to 50 inches over most of the range, with 20 to 30 inches occurring during the growing season. Unusually heavy precipitation--80 inches or more--occurs in portions of the Southern Appalachians. Snowfall averages 50 inches per year in the northern portion of the tree's range and less than 1 inch in the southern portion. Variations in temperatures within its range are as follows (9):

<u>Period</u>	<u>Temperature</u> (Degrees F.)
Average annual	40 to 65
Average July	65 to 80
Average January	15 to 50
Recorded extreme	-40 to 115

The average growing season varies from 140 to 260 days.

EDAPHIC AND PHYSIOGRAPHIC

The site occupied by shagbark hickory varies greatly over its range. In the north, the species is found on upland slopes, while farther south, it is more prevalent on deep, moist soils of alluvial origin (7). Boisen and Newlin (4) report on its habitat in specific locations. In the Ohio Valley, shagbark grows chiefly on north and east slopes of fertile uplands; in the Cumberland Mountains, it is confined to the coves and to north and east slopes; and in Arkansas, Mississippi, and Louisiana, it grows principally on river bottoms (fig. 2).

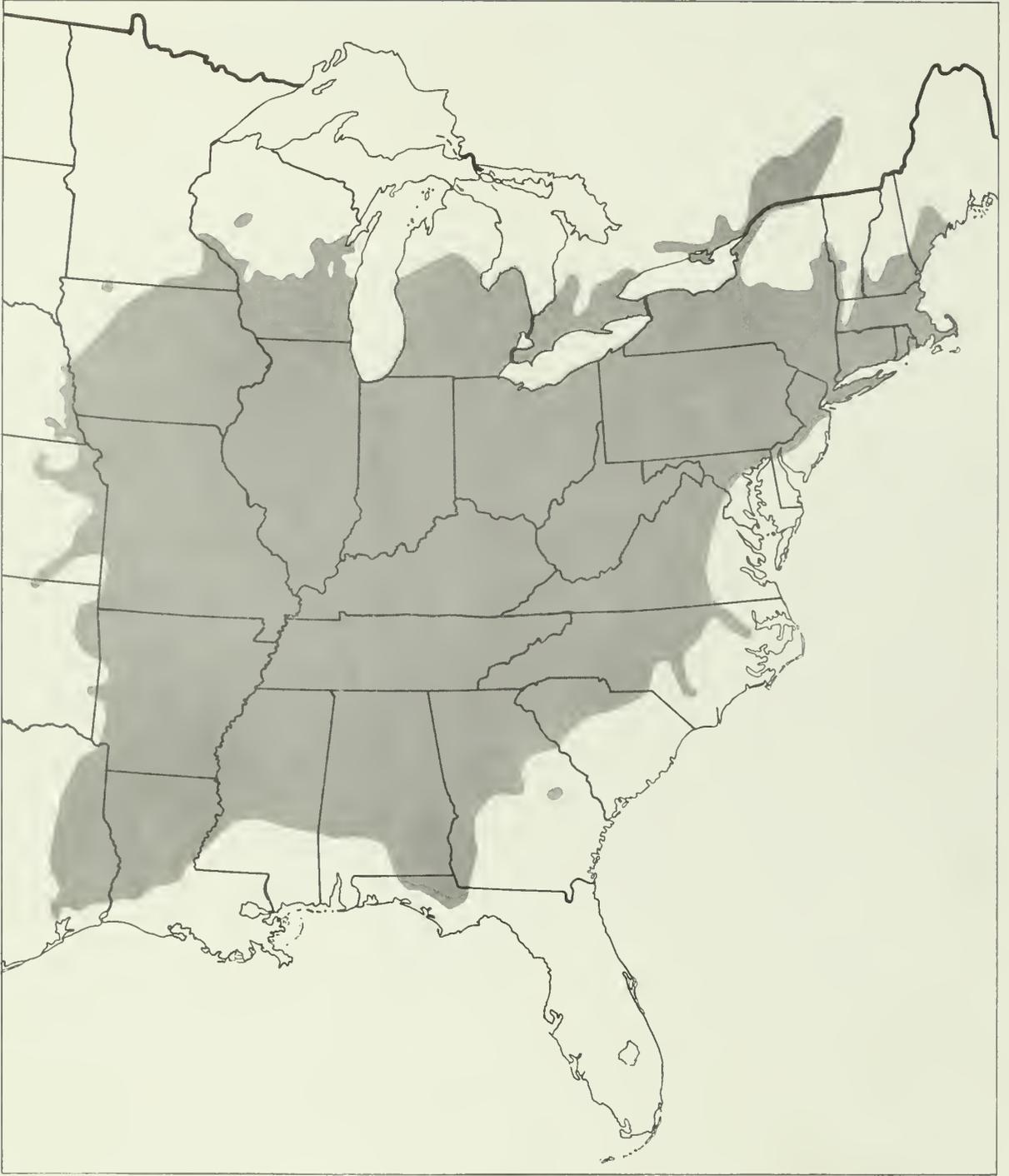


Figure 1. -- Botanical range of shagbark hickory.



Figure 2.--Open-grown shagbark hickory, located near Parsons, West Virginia, in the Monongahela National Forest.

BIOTIC

In the northern part of its range, shagbark hickory is associated with oaks and other hickories, and in the south it is associated with bottomland hardwoods. Table 1 shows common associates for selected locations throughout its range. The Society of American Forester's Committee on Forest Types (13) lists shagbark as a component of the white oak-red oak-hickory, white oak, and swamp chestnut oak-cherrybark oak types.

LIFE HISTORY

SEEDING HABITS

Flowering and fruiting. -- Male and female flowers are borne in separate flowers on the same plant (monoecious). Male flowers are long, slender catkins occurring on new growth or near the summit of the previous season's growth. Female flowers are usually borne in two- to five-flowered spikes, approximately one-third inch in length and clothed with a dense, matted pubescence. Flowers open late in spring after the leaves are nearly full size, i. e., in April or May (12).

Table 1. -- Associates of shagbark hickory in selected sections of its range (5)

Region	Associated species
Cumberland Plateau	White oak (<u>Quercus alba</u>) Black oak (<u>Quercus velutina</u>) Mockernut hickory (<u>Carya tomentosa</u>) Yellow-poplar (<u>Liriodendron tulipifera</u>) Flowering dogwood (<u>Cornus florida</u>) Shortleaf pine (<u>Pinus echinata</u>) Pitch pine (<u>Pinus rigida</u>)
Nashville Basin	White oak Yellow-poplar Sugar maple (<u>Acer saccharinum</u>) American elm (<u>Ulmus americana</u>) Winged elm (<u>Ulmus alata</u>) Black walnut (<u>Juglans nigra</u>) Northern red oak (<u>Quercus rubra</u>) Chinkapin oak (<u>Quercus muehlenbergii</u>) Bur oak (<u>Quercus macrocarpa</u>) Blackgum (<u>Nyssa sylvatica</u>) Black cherry (<u>Prunus serotina</u>) Sweetgum (<u>Liquidambar styraciflua</u>) Sugarberry (<u>Celtis laevigata</u>)
Piedmont Lowland	White oak Northern red oak Black oak Mockernut hickory
Coastal Plain (West of Mississippi River)	White oak Chestnut oak (<u>Quercus prinus</u>) Southern red oak (<u>Quercus falcata</u>) Shumard oak (<u>Quercus shumardii</u>) Mockernut hickory Bitternut hickory (<u>Carya cordiformis</u>)

The fruit ripens in September and October and the seeds are dispersed from September through December (16) (fig. 3).

Seed production. --Shagbark reaches commercial seed-bearing age at 40 years. Optimum seed-bearing age is from 60 to 200 years and the maximum is 300 years. Good seed crops occur at 1- to 3-year intervals, and light seed crops are borne in intervening years (16). If the seed is fresh, 50 to 75 percent of the seed should germinate (14). Several species of nut insects reduce the germinative capacity of shagbark nuts; especially serious are Conotrachelus affinis, Conotrachelus hicoriae, and Laspeyresia caryana.

Shagbark hickory nuts are consumed as food by both humans and wildlife, but there is a very limited commercial market for the nuts. They are an important portion of the diet of red squirrel (Sciurus hudsonicus), eastern gray squirrel (Sciurus carolinensis), eastern fox squirrel (Sciurus niger), eastern chipmunk (Tamias striatus), and raccoon (Procyon lotor). Although the white-tailed deer (Odocoileus virginianus) and wild turkey (Meleagris gallopavo) may consume some of the nuts, the vegetative parts probably are more important foods for these species of wildlife.

Seed dissemination. --Shagbark is a heavy-seeded species and averages 100 seeds per pound. Thus, seed dissemination is by gravity and by animals, principally squirrels.

VEGETATIVE REPRODUCTION

Shagbark hickory is a prolific sprouter. The relations of stump diameter to sprout production and sprout height are shown in table 2. As the stumps increase in size, the number of stumps that produce sprouts decrease, and the proportion of root suckers increases (4).

SEEDLING DEVELOPMENT

Establishment. --Hickories, in general, require a moderately moist seedbed for satisfactory seed germination and early establishment (17). There are also indications that stratification of hickory nuts at winter temperatures slightly above freezing aids germination (2).

Early growth. --Shagbark develops a long taproot early in life. Measurements of seedlings growing in heavy red clay soil showed that, at an age of 1 year, the average root length was about 12 inches.

SAPLING STAGE TO MATURITY

Growth and yield. --Shagbark hickory reaches heights of 130 to 140 feet and diameters of 20 to 30 inches in the Cumberland Mountains. In the bottomlands along the Mississippi River trees grow to larger diameters, but the maximum height growth is usually less than in the mountains. One characteristic of the tree is the tendency for the main stem to fork into two or three prongs at one-half to two-thirds the height of the tree (4).



Figure 3.--Typical bark, twig and bud, fruit, and leaf of shagbark hickory.

Table 2. --Vigor and method of sprouting with increase in diameter of stump in shagbark hickory (4)

Diameter of stump (inches)	Stumps producing sprouts	Sprouts from stump	Sprouts from collar	Sprouts from root	Height of 1-year-old sprouts
		----- <u>Percent</u> -----			<u>Feet</u>
2	100	12	88	0	3.15
4	100	10	76	14	3.05
6	100	8	64	28	2.95
8	100	7	52	41	2.80
10	85	5	40	55	2.70
12	66	4	30	66	2.60
14	47	3	22	75	2.50
16	26	2	17	81	2.30

This species is one of the fastest-growing hickories, but it will produce only about one-fourth to one-half as much merchantable material as a white oak growing under the same conditions of soil and light. Representative growth data are shown in table 3 (4).

Reaction to competition.--Shagbark hickory is classified as moderately tolerant by Harlow and Harrar (7) (fig. 4). When released, suppressed hickories recover rapidly (4).

Shagbark hickory is usually a climax species in the timber types in which it occurs.

Principal enemies.--Shagbark hickory is very susceptible to damage by fire at all ages. Fire wounds allow entrance of heart rot fungi which cause progressive decay resulting in downgrading.

Leaf and twig diseases of the tree are numerous. However, there is little indication that they are factors in forest management. The most common are probably leaf blotch (*Mycosphaerella dendroides*), anthracnose (*Gnomonia caryae*), and witches' broom (*Microstroma juglandis*). *Poria spiculosa* is a common cause of rot in shagbark hickory, resulting in considerable cull and downgrade.

The species is attacked frequently by insects, although most references in the literature mention the genus *Carya* rather than shagbark itself. Hickory bark beetle (*Scolytus quadrispinosus*), however, probably causes considerable damage. Younger trees are particularly susceptible to attack by *Oncideres cingulatus*, *O. texanus*, and *O. pustulatus* (8).

Table 3. --Average growth rates of shagbark hickory in selected portions of its range (4)

Age (years)	Seedling growth				Coppice growth	
	D. b. h.	Height			D. b. h.	Height
	Indiana, Kentucky ^{1/}	Ohio Valley ^{2/}	Cumberland Mountains ^{2/}	Mississippi Valley ^{2/}	Indiana, Kentucky	Indiana, Kentucky
	<u>Inches</u>	----- <u>Feet</u> -----			<u>Inches</u>	<u>Feet</u>
10	1.2	7	3	4	2.4	13
20	2.8	18	13	8	4.4	26
30	4.0	32	20	15	6.3	38
40	5.4	43	27	23	7.4	46
50	6.8	51	34	32	8.6	54
60	8.0	58	41	41	--	--
70	9.4	64	48	50	--	--
80	10.5	70	54	58	--	--
90	11.6	75	60	65	--	--
100	--	79	66	71	--	--
120	--	--	78	81	--	--
140	--	--	89	90	--	--
160	--	--	99	97	--	--
180	--	--	108	103	--	--
200	--	--	116	109	--	--

^{1/} Second growth.^{2/} Virgin.

RACES AND HYBRIDS

There is no evidence so far to show races of shagbark hickory, but there are a number of varieties and hybrids. Carolina hickory, sometimes called southern shagbark hickory (Carya carolinae - septentrionalis (Ashe) Engl. & Graebn.), was combined with shagbark hickory in the 1953 Check List (10). It reaches commercial proportions in the Piedmont and ranges from central North Carolina to northern Georgia and northeastern Mississippi and west through eastern Tennessee (7). Bishop (3), discussing its distribution in Georgia, states that it is usually found in low, flat woods and river bottoms in the eastern Piedmont and mountains.

Bailey (1) recognizes three trade varieties of Carya ovata: var. Halesii, Hort.; var. Nuttalii, Sarg.; and var. fraxinifolia, Sarg.

Caldwell (6), studying natural variations of shagbark in central New York, found considerable diversity in morphological characteristics, the greatest occurring in the size, shape, and color of the nut, in the thickness of the shell, and in sweetness of the nutmeat.

Little (10) recognizes two hybrids of shagbark hickory: Carya X dunbarii Sarg. (Carya laciniosa x ovata) and Carya X laneyi Sarg. (Carya cordiformis x ovata). In addition, Richens (11) lists shagbark as crossing with pecan (Carya illinoensis).



Figure 4. --Forest-grown shagbark hickory, located in the George Washington National Forest, Virginia. Note the natural pruning which has taken place under forest conditions.

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