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Scrub Hickory: A Florida Endemic • The Evil Weevil And The No-Name Fly • Obtaining Research And Collecting Permits

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Fig. 7

by Drs. James N. Layne and Warren G. Abrahamson

Scrub Hickory: *A Florida Endemic*

Scrub hickory (*Carya floridana* Sargent), also known as Florida hickory, is one of Florida's more conspicuous endemic plant species. It occurs on the Atlantic coastal dunes from Volusia County south to Palm Beach County and in xeric upland sites in the south-central and west-central regions of the peninsula from Marion County on the north to Charlotte County on the south.

C. S. Sargent (1922) stated that the species also occurred "on the shores of Pensacola Bay" in the Florida panhandle, but he was presumably referring to the sand or pale hickory (*C. pallida*). The scrub hickory was described by Sargent in 1913 as *Hicoria floridana* and later assigned to the genus *Carya* by J. K. Small (1933). The type specimen was collected by B. K. McCarty in 1911 in St. Lucie County about 5 miles (8 kilometers) south of Ft. Pierce. McCarty wrote to Sargent that he had found no ripe fruit and, as a result, a fruit collected by R. T. Morris at the same locality was used for the type in the species' description (Murrill 1946). Although they recognized the species, H. Kurz and R. K. Godfrey (1962) questioned its validity on the basis of the occurrence of specimens intermediate in size and other characters between scrub hickory and pignut hickory (*C. glabra*) in transition zones between scrub and sandy hammock vegetation.

Scrub hickory is particularly characteristic of the xeric sand pine scrub association of the Lake Wales Ridge. In fact, Small was so impressed with its abundance near the southern end of the ridge that in 1914 he prevailed upon the Atlantic Coastline Railroad to change the name of a railroad stop in Highlands County south of the town of Lake Placid from "Red Hills" to "Hicoria" (Wilson 1995). The local post office was also given the same name. In 1923, Hicoria was the center of the naval stores and turpentine operations of the Consolidated Naval Stores company and in 1928 was the site of a logging operation of the Sherman Lumber Company with its associated residential buildings and commissary (DeVane 1978). Today, the only trace of this long-abandoned operation are the concrete supports of the former buildings now hidden in the dense scrub vegetation.

Scrub hickory is typically a shrub or small tree 3-5 meters high but has been reported to reach a height of 25 meters (Small 1933). However, a Highlands County specimen listed by American Forests (2004) in its National Register of Big Trees had a height of only 47 feet (14.3 meters) and a diameter of 19.7 inches (50.7 centimeters), based on the circumference of 62 inches. Sargent (1922) noted that in the interior of the peninsula the species occurs typically as a shrub. The maximum height of scrub hickories we sampled in natural habitats in Highlands County was 7.6 meters. However, considerably larger specimens are found in suburban and urban areas in the region where growing conditions are presumably more favorable. For example, an individual in a vacant lot in the town of Lake Placid had a height (estimated with a clinometer) of 13.4 meters and a diameter of 120.9 centimeters before dividing into several trunks. Unfortunately, this tree along with many other large scrub hickories in residential areas in the Lake Placid area were casualties of Hurricane Jeanne.

Scrub hickory has a clonal growth pattern, with the separate stems (ramets) often forming distinct clusters termed a "multi-trunk" condition by Grauke (2002). Larger tree-sized clones may have a dozen or more separate, diverging trunks. The yellowish-green compound leaves usually have 3 to 5, and more rarely 7, leaflets with a rusty pubescence on the lower surface when young. The mature leaves retain a rusty tinge on the lower surface. The outer bud scales overlap and are covered with small rusty-colored scales. The bark is typically grayish and relatively

smooth, with prominent interconnecting, longitudinal fissures that tend to be parallel; and the trunk and larger branches usually bear conspicuous patches of lichens. [Fig, 1] The bark on the lower trunk of old trees in shady, long-unburned habitats is almost black and deeply furrowed, and the larger branches may be heavily encrusted with foliose lichens. [Fig, 2]

The species is monoecious, with flowers appearing in the spring along with the new leaves. The staminate flowers consist of 3-branched catkins, and the 2-10 tiny pistillate flowers occur as tightly-crowded clusters at the ends of the twigs. [Fig. 3] Scrub hickory has been determined to be a tetraploid with 64 chromosomes, and, although it has a relatively large stomatal area characteristic of tetraploid species, its pollen is the smallest of any tetraploid member of the genus (Stone 1963). Despite the multiple flowers, typically only a single nut matures. For example, in one scrub site in Highlands County single nuts occurred in 93 percent of the cases and two nuts in only 7 percent. There was a suggestion in this sample that twin nuts tended to be more frequent on certain trees, perhaps reflecting a genetic effect. Double nuts may occur on individuals as small as 1 meter in height as well as on larger trees.

The nut is enclosed in semi-woody husks that are relatively thin, persistent, and separate irregularly. [Fig. 4] The surface of the hull varies from smooth to roughened with many tiny projections. The shape of the fruit varies from narrowly pear-shaped and elongate to globular, with fruits on the same plant having the same general shape.[Fig. 5] Small (1933) attributed the great variation in shape and size of fruits to the species' occurrence in very late and unstable physiographic areas. The nut itself is thick-shelled with a ridged surface and often with a stalk-like base. [Fig. 6] Compared with other hickory species, the nut of scrub hickory is relatively small, with a diameter of 2.0-2.5 centimeters and an average mass of 3.4 grams (Abrahamson and Abrahamson 1989). The nut is "sweet," reflecting a relatively low tannin concentration, and has considerably higher nutritional and energy content than the acorns of the five species of oaks and fruits of the two species of palmettos occurring in the same habitats.

Scrub hickory is closely related to pignut hickory (*C. glabra*) and black hickory (*C. texana*), as indicated by such shared characteristics as the rusty pubescence of young leaves and number of leaflets and similarity in the composition of the nut oils (Stone et al. 1969). In fact, the resemblance between scrub hickory and black hickory is so strong that identification of herbarium specimens of the two species requires knowledge of their geographic origin. Pignut hickory is widespread in relatively mesic habitats from southwestern New Hampshire to eastern Illinois and south to Louisiana and central peninsular Florida. Black hickory occurs in dry upland sites mainly west of the Mississippi River from Iowa and Illinois south to eastern Texas and western Louisiana.

Based on the study by Stone et al. (1969) of the composition of the nut oils of hickories, the sand hickory (*C. pallida*) is also related to the scrub, black, and pignut hickories. This species occurs on sandy well-drained soils from Virginia to Tennessee and south to Louisiana and the Florida panhandle, with isolated populations as far north as Delaware and New Jersey. In Florida it is found sporadically from Santa Rosa to Leon counties, primarily in longleaf pine-oak woodlands. Intergrades between scrub, black, sand, and pignut hickories occur in areas where their ranges overlap. In Florida, pignut hickory and scrub hickory often occur in the same area, with the former in moist habitats and the latter in xeric uplands. Other Florida examples of a pair of closely related plants that occur in the same geographic region with one member occupying more mesic environments and the other xeric uplands include red bay (*Persea borbonia*) and silk bay (*P. humilis*), live oak (*Quercus virginiana*) and sand live oak (*Q. geminata*), and American holly (*Ilex opaca*) and scrub holly (*I. opaca* var. *arenicola*).

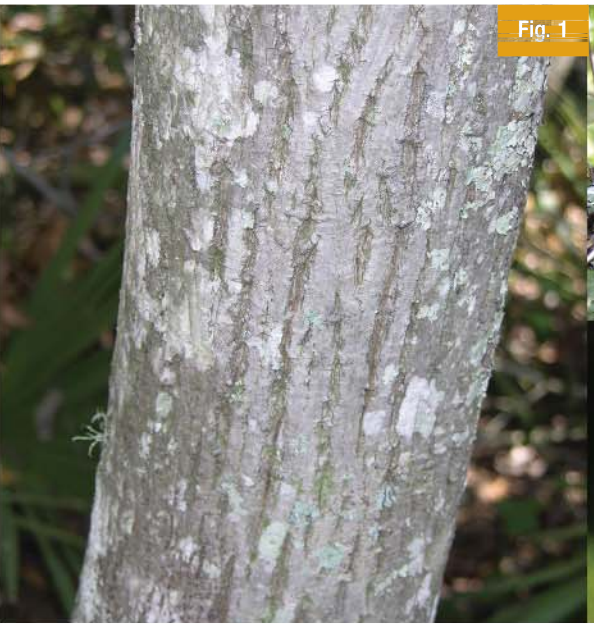
The close relationship of scrub hickory and black hickory with widely separated ranges at the present time reflects an evolutionary

Fig. 1 *The bark of scrub hickory is typically relatively smooth, grayish, and dissected by deep, interconnected longitudinal fissures. Patches of lichens are frequent. The bark of the basal portion of the trunks of old trees growing in shady, long-unburned sites is almost black and more deeply furrowed.*

Fig. 2 *Larger branches of scrub hickories growing in old-growth vegetation associations often support dense growths of foliose lichens.*

Fig. 3 *The tiny pistillate flowers of scrub hickory occur as dense clusters at the tips of the twigs.*

Fig. 4 *The husk of the ripe scrub hickory fruit separates irregularly, often in three parts.*



history similar to that of a number of animal species, such as the gopher tortoise, indigo snake, crested caracara, scrub jay, pocket gopher, and Florida mouse, with nearest relatives in Florida and western North America or Central America.

According to our hypothesis the evolution of the scrub hickory involved the isolation of the ancestral stock on the small island (presently represented by "Red Hill" on the Archbold Biological Station) that existed in the region of the southern end of the present Lake Wales Ridge during the high stand of sea level in the upper Miocene period or, alternatively, at a later time on the more extensive insular land mass corresponding to the present-day Lake Wales Ridge that existed during a high stand of sea level in the mid-Pliocene period. (Alt and Brooks 1965) which led to its adaptation to xeric, deep sandy soils of marine origin. The subsequent retreat of sea level far below the present level during the maximum Wisconsin glacial advance in the following mid-Pleistocene period resulted in a near-doubling of the size of the Florida peninsula and a lowering of the water table by 26-31 meters, creating conditions allowing the expansion of the xeric vegetation association designated as "sand-dune scrub" by the plant geographers H. R. and P. A. Delcourt (1984). As a result, scrub hickory was presumably able to expand its range well beyond the present limits. A study by W. A. Watts and B. C. Hansen (1988) of pollen in cores of sediments from Lake Annie, a deep sink-hole lake near the southern end of the Lake Wales Ridge, documented the presence in the region of an arid vegetation association with hickory, presumably scrub hickory, as one of its components from about 50,000 years (the beginning of the record) to 9,800 years BP (before the present), with the appearance of pollen of more mesic-adapted species following that period. This trend in the pollen record correlates with the progressive rise in sea level and the related rise in the water table of peninsular Florida following the end of the Wisconsin glacial period about 13,500 BP, which resulted in a reduction in the area of the peninsula and extensive replacement of xeric habitats by more mesic vegetation associations such as pine flatwoods, hardwood hammocks, cypress swamps, bayheads, and peatlands. As a result, by 5,000 BP the xeric habitats occupied by scrub hickory had become restricted to well-drained sands of the central peninsular uplands and coastal dune systems.

On the Archbold Biological Station near Lake Placid in south-central peninsular Florida where we have studied the scrub hickory for many years, the species occurs in three major xeric upland vegetation associations, namely, southern ridge sandhill, sand pine scrub, and scrubby flatwoods (Abrahamson et al. 1984). The southern ridge sandhill association has an open canopy of south Florida slash pines (*Pinus elliottii* var. *densa*) and sand pines (*Pinus clausa*) and an understory of small trees and shrubs comprised mainly of myrtle oak (*Quercus myrtifolia*), Chapman's oak (*Q. chapmanii*), sand live oak (*Q. geminata*), turkey oak (*Q. laevis*), scrub hickory, and palmettos (saw palmetto, *Serenoa repens*, and scrub palmetto, *Sabal etonia*). The understory is generally dense, but interrupted with open areas with thin litter or exposed sand. Ground cover includes stems of the shrub layer species in areas of shrub cover and herbaceous plants, lichens (*Cladonia* spp.), and spike moss (*Selaginella arenicola*) in the open areas. The presence of scrub hickory is one of the features, in addition to the replacement of longleaf pine by South Florida slash pine, distinguishing southern ridge sandhill vegetation from its more northerly counterpart in Florida. In fact, one phase of the sandhill vegetation type in the southern ridge area is characterized by having scrub hickory rather than turkey oak as the dominant hardwood species. The sand pine scrub association has a nearly closed canopy of sand pines, and a small tree-shrub understory of most of the same species as in sandhill. Ground cover consists mainly of sprouts of the shrub layer components, with few herbaceous species. The litter layer is generally well-developed with fewer openings with sparse litter or bare sand than the sandhill site. Scrubby flatwoods has a widely open tree layer consisting of slash pines and sand pines; a generally dense shrub layer; with interspersed openings with herbaceous species and lichens.

Fig. 5 *A fruit of scrub hickory with a narrow, obovate shape that differs from the usually more globular form. All fruits on the same tree have a similar shape.*

Fig. 6 *Mature nuts of scrub hickory.*

The endemic Archbold oak (*Q. inopina*) is a characteristic component of the shrub layer of scrubby flatwoods.

Scrub hickory is generally distributed in the southern ridge sandhill and sand pine scrub vegetation types but has a more restricted distribution in scrubby flatwoods, where it is often lacking or occurs only as isolated individuals probably resulting from occasional nut dispersal by birds from sites with higher numbers of the species.

Historically, the vegetation associations inhabited by scrub hickory were subject to periodic lightning-ignited fires that maintained an open tree canopy, a sparse shrub layer, and extensive open areas with herbaceous vegetation or bare sand.

Historically, the vegetation associations inhabited by scrub hickory were subject to periodic lightning-ignited fires that maintained an open tree canopy, a sparse shrub layer, and extensive open areas with herbaceous vegetation or bare sand. Under the natural fire regime, sandhill and scrubby flatwoods were subject to relatively frequent burns, while scrub experienced less frequent but high intensity fires. Scrub hickory is well-adapted to fire and following a burn quickly regenerates through production of new ramets rather than through germination of nuts in the soil bank. Most other perennial plants in these associations also regenerate by vegetative means rather than from seeds following fire (Abrahamson 1984).

In a study we conducted on the effects of a prescribed fire in a long-unburned sandhill association, new scrub hickory ramets produced a few nuts within a year following the burn, but full recovery of nut production by larger ramets required more than 5 years (Layne and Abrahamson 2004). In contrast to scrub hickory, the larger oaks on the burned plot, particularly species of the white oak group, tended to have higher production than on the unburned control plot during the 5 years following burning. The density of scrub hickory ramets also increases with time since fire. For example, R. L. Myers and D. L. White (1987) documented a 393 percent increase in the number of stems less than 5 centimeters in diameter in a sandhill association over a span of 52 years beginning 5 years after a major fire.

The phenology of scrub hickory in the southern Lake Wales Ridge region involves the appearance of new leaves in late January or early February, with considerable individual, site, and year-to-year variation in the timing of leaf development. Leaf development continues through March and by early April leaves are fully developed on some trees. Flowering occurs from about late January to mid-April coincident with the emergence of leaves and during the time of year with greatest air movement, which presumably maximizes pollination efficiency. In some years, many trees have well-developed nuts by late May and nearly full-size but still green nuts are present by early July. Some nuts have ripened and begun to fall by late August but most are shed from September to November.

By late August the leaves of many trees have acquired a bronzy tinge, and leaves begin turning color from early October through early December, depending on the year. The leaves are bright yellow when first turned, providing a sharp contrast to the green canopy of the evergreen oaks, and later turn brown. There is much individual as well as year-to-year difference in the timing of these color changes. Even late in the season some trees retain leaves that may still be partly green, bright yellow, or brown, with most leaves having been shed by the end of January. A hard freeze tends to synchronize color change and leaf drop, with the shed leaves often forming a thick carpet on the ground beneath the tree.

The number of nuts produced by scrub hickory is strongly correlated with the size of the ramet; and the average number of nuts per ramet for combined size classes over a 28-year period on our study sites was 11.8 in sandhill, 5.8 in sand pine scrub, and 12.3 in scrubby flatwoods (Layne and Abrahamson 2004). The highest number of nuts recorded on a single tree was 350. The low average number of nuts per ramet produced by scrub hickory in the sand pine scrub association was similar to our observations on acorn production by the four oak species of that association (Abrahamson and Layne 2003) and presumably reflects the lower light-level in the nearly closed-canopy of the mature scrub. Based on the mean number of nuts for different size classes and the densities of the respective size classes as determined by periodic vegetation surveys, we estimated that the average annual nut production by scrub hickory in the three vegetation associations studied was 348 per hectare in sandhill, 464 per hectare in scrub, and 47 per hectare in scrubby flatwoods (Layne and Abrahamson 2004).

There was considerable year-to-year variation in the nut crop in each vegetation association, with the proportion of ramets bearing nuts having a greater effect on the size of the crop than the average number of nuts per ramet. Annual crops ranged from 22 to 775 nuts per hectare in sandhill, 11 to 1635 nuts per hectare in sand pine scrub, and 1 to 280 nuts per hectare in scrubby flatwoods. Average intervals between higher annual crops in the three vegetation types ranged from 2.6 to 3.2 years, periodicities that are generally comparable to those reported for nut production by other hickory species in various localities and habitats in the United States. Statistical analysis indicated that about 42 to 62 percent of the variation in yearly nut production in different vegetation types was explained by temperature and rainfall conditions, with average maximum winter temperature, average minimum spring temperature, and winter rainfall having the greatest effects.

The high nutrient and energy content of the scrub hickory nut makes it a potentially important wildlife food species, and at least 14 species of vertebrates are known or presumed to feed on the nuts in our study areas. [Fig. 7] The gray squirrel and southern flying squirrel are probably the principal mammalian consumers and dispersers of the nuts. Scrub hickory nuts comprised 85 percent of the food items found in nest boxes occupied by these species. In contrast, based on our annual censuses of mast crops in the different vegetation types, scrub hickory nuts accounted for only 0.5 to 16.7 percent of the combined hickory nut and acorn production. Thus the high frequency of scrub hickory nuts in nest boxes suggests that the squirrels were selectively collecting them. Studies elsewhere in the United States have indicated a similar greater preference by squirrels for hickory nuts than acorns. Aside from their possible attractiveness to squirrels because of their high energy content, the higher frequency of scrub hickory nuts than acorns in nest boxes may also reflect a greater tendency of squirrels to

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transport hickory nuts to nest boxes for opening to reduce their exposure to predators, as C. C. Smith and D. Follmer (1972) in a study in Missouri found that gray squirrels took an average of 184 seconds to remove the husk and open the shell of shagbark hickory nuts compared with 15-28 seconds for opening the shell of acorns. Besides squirrels, other mammals known or suspected to utilize scrub hickory nuts include black bears, raccoons, foxes, several species of native mice, and feral hogs. The leaves of scrub hickory are also utilized by squirrels to construct outside leaf nests and are superior for this purpose to those of the oaks (except turkey oak) and other available shrub and tree species.

Birds recorded to feed on scrub hickory nuts include the Florida scrub jay, blue jay, red-bellied woodpecker, and red-headed woodpecker. [Fig. 8] In an intensive study of caching behavior of blue jays at the Archbold Biological Station, C. A. Adkisson of Virginia Polytechnic University has repeatedly observed blue jays transporting acorns for long distances but has never recorded long-distance transport of scrub hickory nuts by the jays. Presumably the size of the nut, approximately 38 percent heavier than the largest acorn (turkey oak), precludes long distance transport by birds or small mammals. This may account in part for the restricted geographic range of scrub hickory as compared with that of the oaks characteristic of the scrub association in Florida. Scrub hickory sap also appears to be attractive to yellow-bellied sapsuckers during the winter months based on the number of larger trunks with closely-spaced scars from sapsucker drill holes.

The only invertebrate animals known to feed on scrub hickory nuts are the larvae of curculionid beetles (weevils), which may infest 23 to 53 percent of the nut crop in some years. The stomach of a black bear killed on a highway near our study area contained remains of scrub hickory nuts along with numerous weevil larvae from the nuts, suggesting that beetle infestation does not necessarily reduce the palatability of the nut to consumers and in fact may actually enhance its nutritive value.

The scrub hickory is clearly a noteworthy member of the Florida flora. In addition to its biological significance as one of the state's more conspicuous endemic species, a characteristic member of the sand pine scrub and other xeric ecosystems of the central peninsular region, and an important wildlife food source, its attractive appearance gives it potential economic value as a landscape plant. In fact, because of its adaptation for dry conditions, the scrub hickory would appear to be a particularly good candidate for use in xeriscaping to promote water conservation.

Fig. 8 *The Florida scrub jay (Aphelocoma coerulescens) is one of several birds known to feed on scrub hickory nuts when available.*

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