



Native Hickories of Georgia II: Identification Characters & Species Descriptions

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The genus *Carya* -- hickories, are difficult to accurately identify to species level due to large variations in identification traits and large number of species and varieties. In addition, hickories generate a number of both recognized and unnamed hybrids, increasing visual diversity for identification. Most field identification relies upon a single visual trait to approach species identification which leads to significant errors. Glossing-over or under-estimating hickory trait variability deludes correct species identification. This is the second of two publications dealing with the genus *Carya* and describes its many native and naturalized species in Georgia. Figure 1 shows the current native, naturalized, and out-of-range species impacting Georgia along with historic or synonym names.

Before examining individual species descriptions of native *Carya* species, it is important to look at common features of all hickory species. Identification of common visible macro-features of the *Carya* genus as a whole includes the following features: Figure 2.

Tree & Wood Form: Hickory species are deciduous trees of varying heights (tree form 10 - 160 ft tall) usually with upright crowns. When young, all have pronounced taproot structures. Figure 3 presents moisture regimes and general habitat types by species. Wood is generally ring-porous. *Apocarya* section species (pecan hickories) tend to have a more semi-ring porous wood structure than other hickories. *Apocarya* section species have a lower density and weaker wood than species in the *Carya* section (true hickories) of the genus which has harder, more dense wood.

Leaves & Leaflets: Leaves are deciduous, attached alternately along the twig with no stipules at their base. Leaves are odd-pinnately compound with some species having a proportionally large terminal leaflet. Figure 4 presents average leaf length (inches) by species. Figure 5 adds the range of leaf lengths (inches), and shows the large variation and overlap of leaf lengths. Leaves with 3-21 (5-17 usual) leaflets. Figure 6 presents average number of leaflets per leaf by species. Figure 7 adds the range in number of leaflets per leaf across species, showing a large variation and overlap in number of leaflets. Figure 8 provides a diagram of a single hickory leaf with five leaflets. Figure 9 shows the range and variation of terminal leaflet stem (petiole) lengths (inches) by species. Leaflet margins are coarsely to finely serrate with teeth < 1/6 inch long. Crushed leaves and leaflets are pungent or aromatic, with some crushed leaflet aroma identifiable to species. Leaflets usually with bright yellow to golden-yellow fall coloration.

Twig & Buds: Twigs without thorns or prickles (unarmed). Twig pith solid, not chambered. Figure 10 shows the average terminal bud length and its range by species. Figure 11 shows an example of a twig tip and terminal bud, in this case for *Carya ovata* (shagbark hickory).

Flowering: Flowering in *Carya* is complex and requires minute observations. Trees are monecious, bearing unisexual male and female flowers on the same tree but as separate flowers. The male and female flowers are generated in Spring as new leaves are expanding. Male flowers are drooping catkins growing from lateral buds or leaf axils at or near the end of twigs. Female flowers are small and inconspicuous, clumped together in 1-10 flowers per cluster on a short upright spike at the tip of the current year's twig. Pollen in a tree is not shed when female flowers on the same tree are open. Hickory species between bottomland and uplands can all shed pollen and bear receptive female flowers close in time to each other in Spring, allowing for a number of hybrids to form.

Fruit & Nuts: Hickory fruit are husks surrounding a single nut maturing in Fall. The husk has a number of sutures (usually 4) which split partially or fully, revealing the nut within. Fruit with nuts, or nuts alone, can fall when mature. The fruit and nut are relatively large. Figure 12 provides the average fruit length and range by species.

Periderm / Bark: Figure 13 presents periderm types, textures, and variation by species.

Generalized Range in Georgia: Figure 14 shows native and naturalized *Carya* species range maps. Note *Carya myristiciformis* (nutmeg hickory) has only one confirmed identification citation in Georgia, therefore the best estimate of its habitat range is provided in hopes of finding a population or more individuals of this rare species.

Field Identification

The best means of identifying native hickory species can be concentrated into eight macro-field features:

1. number of leaflets;
2. undersurface appearance of leaflets;
3. terminal bud shape and color on twig;
4. bud scale surfaces and edges;
5. fruit size, shape, and surface appearance;
6. different forms of tricombs & scales present on various surfaces
(difficult without magnification aid);
7. periderm (bark) type; and,
8. tree habitat.

It is important to not use single features for identification in hickories. Because of varieties, forms, and hybrids, the range of any one feature can be quite wide and overlap with a number of other hickory species. It is recommended identification be based upon at least four of the eight macro-field features listed above.

Defining Terms

Several terms used in individual species descriptions need clarifying.

One term is “hair” or “hairy.” Hickories have no hair, as hair denotes an animal source. Hair-like structures on a tree are actually external filamentous or flattened surface organs called trichomes or scales. Leaf, bud, and twig surfaces may be evenly covered or dotted with tufts of trichomes or scales. In tree surface biology there are many terms for different surface trichomes and scales including:

- scaly or flaky growths described as powdery, granular, and scarfy (>10 description types);
- warty or bumpy surface textures including descriptors blistery, rough, and raised (>14 description types); and,
- hair-like or bristle-like trichomes including >60 descriptors divided by differing length, feel to touch (soft / stiff), and whether relatively evenly distributed across the surface or clumped.

The generic term hair and hairy are used here, but denote trichomes.

Another set of terms describe gas ports on twig surfaces, leaflet connections to the rachis, and the appearance of leaflet or bud scale margins.

Lenticels are specialized gas ports on twig surfaces allowing for gas exchange with the atmosphere. They can have a number of features and appearances including unique shapes and colors.

Petiolules are short segments of a leaf which connects leaflets to the rachis or main leaf axis. Here the term “leaflet stem” is used as an equivalent term (refer to Figure 8).

Ciliate is a term used here for the edges of leaflets and serrations which have a fringed appearance.

In the species description text, an average and range of values are provided for measurable items such as leaflet number and leaf length. The “n” value listed after the range values denote the number of cited authors providing values to the range values. The other “n” is used for the number of chromosomes of each species along with a descriptive term such as diploid or tetraploid.

What follows are the individual hickory species descriptions:

Scientific name: *Carya aquatica*.

Year first identified: 1818.

Common name: water hickory.

Other common names: bitter pecan, swamp hickory, wild pecan, bitter water hickory.

Carya genera section: Section A (*Apocarya*), the pecan hickories.

Tree & Site:

Water hickory can be a large tree reaching the largest expected height of 90' (range 80-115'; n=3) and largest expected diameter of 2.3' (range 1.5-3.3'; n=5). The usual height seen is 45' which is roughly 50% its largest size. Water hickory has a narrow crown with upright branches and a straight stem. It can be found growing in swamps, bottomlands, clay flats, backwaters along rivers, wetlands, flatwoods, and Coastal Plain floodplains.

Leaves & Leaflets:

Water hickory leaves are 14.7" (range 9-24"; n=6) long with dark red hairy petioles which are 1.2-3.2" long. Leaves have (7)9-11(15) n=6 leaflets which are 4" (range 0.8-7.5"; n=6) long and 1" (range 0.4-1.6"; n=4) wide. The terminal leaflet is roughly equal in size to lateral leaflets. Water hickory leaflets have yellow glandular dots on their surface, and margins which are finely serrate to entire and wavy. Note, this is the only southeastern United States hickory which can be found with occasional smooth or entire leaf margins. Leaflets are dark green & hairless above with an underside along the veins and in axils with dark red to rusty colored hairs. The leaflet stems (petiolules) of lateral leaflets are 0-0.08" long and the terminal leaflet stem is 0.25-0.4" long.

Buds & Twigs:

Water hickory terminal buds are rusty to dark reddish brown with yellow scales, but no silvery scales. The terminal bud is 0.3" (range 0.13-0.5"; n=6) long and is elongated and flattened in cross-section with 4-6 bud scales. The twigs are slender and brown with many visible lenticels.

Fruit & Nut:

Water hickory fruit has sutures which are slightly winged, has a rough husk surface with yellow scales, and splits from 75% to all the way to its base. There are usually 3-4 fruit per twig cluster. Fruit is 1.1" (range 0.6-1.75"; n=7) long and 1" (range 0.6-1.5"; n=4) in diameter. The nut is bitter, flattened, and thin shelled.

Periderm:

Water hickory has a shaggy bark.

Genetics:

Water hickory has two sets of chromosomes (diploid n=16). It hybridizes with: *Carya illinoensis* (*Carya X lecontei*); and, *Carya texana* (*Carya X ludoviciana*).

Scientific name: *Carya carolinae-septentrionalis*

Year first identified: 1902

Common name: southern shagbark hickory.

Other common names: Carolina hickory, Carolina shagbark hickory

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Southern shagbark hickory can be a large tree with the largest expected height of 100' (range of 80-118'; n=2) and largest expected diameter of 2.5'. The tree's usual height is 40' with 1' in diameter. It grows on upland moist slopes, toe-slopes, river bottoms, first terraces along streams, moist woods, and better drained lowlands.

Leaves & Leaflets:

Southern shagbark hickory leaves are 9" (range 4-14"; n=6) long with a slender petiole 1.6-4.7" long. Leaves have (3)5(7) n=2 leaflets. Upper leaflets are 3-4.5" long and 1-1.5" wide, roughly 2X times larger than the lowest leaflet pair. The leaves and leaflets are smaller and more narrow than shagbark hickory (*Carya ovata*). Southern shagbark hickory leaflets have a smooth underside except for vein axils which can have hairs. The leaflet margins are serrated with ciliate edges, especially early in the season. The terminal leaflet stem (petiolule) is 0.12-0.5" long.

Buds & Twigs:

Southern shagbark hickory terminal bud is smooth, bright reddish brown to shiny black and is 0.4" (range 0.2-0.6"; n=4) long. The terminal bud is oval-shaped and round in cross-section with 6-15 bud scales. Twigs are smooth, slender, 0.04-0.12" in diameter, dark reddish brown to dark brown in color, shiny, and lacking any noticeable scales.

Fruit & Nut:

Southern shagbark hickory fruit is dark red-brown with a rough surface and sutures which are not winged. The fruit is 1.1" (range 0.75-1.5"; n=5) long. Compared with shagbark hickory (*Carya ovata*), the fruit is smaller by roughly 30%. The nut is 1" long and sweet.

Periderm:

Southern shagbark hickory bark is shaggy and dark reddish brown.

Genetics:

Southern shagbark hickory has two sets of chromosomes (diploid n=16).

Notes:

Southern shagbark hickory range generally covers central NC, south and west into SC to north GA and east TN, east MS, and AL. This species was accepted in 1969, but was once considered a southeastern variety of shagbark hickory "*Carya ovata* var. *australis*." Southern shagbark hickory has more slender twigs, darker outer bud scales, and grows on sites with thinner soils and higher pH than shagbark hickory (*Carya ovata*).

Scientific name: *Carya cordiformis*.

Year first identified: 1869.

Common name: bitternut hickory.

Other common names: swamp hickory, pignut hickory, noyer amer, caryer cordiforme.

Carya genera section: Section A (*Apocarya*), the pecan hickories.

Tree & Site:

Bitternut hickory is a medium to large tree with the largest expected height of 80' (range 50-120'; n=6) and a diameter of 3' (range 1-4'; n=5). Usually trees are found which are 50' tall and 1.2' in diameter. Bitternut hickory has stout branches, a tall trunk, and a broad open rounded crown. It can be found growing in a wide range of sites. Habitats include bottomland to slope forests, mixed hardwood stands, first terraces of streams, and toe slopes. This species is common and found widely.

Leaves & Leaflets:

Bitternut hickory leaves are 8.8" (range 6-13"; n=6) long with 7-9(11); n=6 leaflets. The leaflets are 4.5" (range 1.2-7.5"; n=6) long and 1.3" (range 0.4-2.8"; n=4) wide. The terminal leaflet is equal in size to lateral leaflets. Bitternut hickory leaflets are smooth above and hairy below especially near the rachis. Leaflets are finely serrate, slightly hairy and scaly, yellow-green above and light green below. The leaflets are connected directly to the rachis (sessile) or nearly so. Lateral leaflets can have stems (petiolules) 0-0.04" long with terminal leaflet stems 0.08-0.3" long.

Buds & Twigs:

Bitternut hickory terminal buds are bright sulfur yellow, yellow brown, to bright orange-yellow in color, densely scaly with yellow colored scales and lacking any silvery scales. Terminal buds are 0.5" (range 0.3-0.75"; n=5) long. The terminal bud is elongated and flattened in cross-section with 4-6 bud scales. Twigs are slender and smooth.

Fruit & Nut:

Bitternut hickory fruit husk is rough, thin, and covered in small yellow scales and hairs. The fruit sutures split to the mid-point and are slightly winged to winged (keeled). Fruit is 1" (range 0.75-1.5"; n=8) long. The nut is thin-shelled, rough, bright reddish brown in color, and flattened with a very bitter seed.

Periderm:

Bitternut hickory bark texture is tight with long furrows to small platey scales.

Genetics:

Bitternut hickory has two sets of chromosomes (diploid n=16). *Carya cordiformis* var. *latifolia* is identified with 2.5X - 3X wider and longer leaflets than *Carya cordiformis*. Bitternut hickory hybridizes with: *Carya glabra* (*Carya X demareei*); *Carya illinoensis* (*Carya X brownii*); *Carya laciniosa* (*Carya X* _____); and, *Carya ovata* (*Carya X laneyi*). Bitternut hickory is closely related to *Carya illinoensis* – pecan.

Scientific name: *Carya floridana*.

NOT NATIVE – native farther South in north-central Florida.

Year first identified: 1913.

Common name: scrub hickory.

Other common name: Florida hickory

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site: Scrub hickory can grow to 60' (range 50-70'; n=3) in height and 2.0' in diameter. It is usually found with a height of 18' and a diameter 10". Scrub hickory has slender spreading branches with a broad crown. It is a rare tree, usually more shrub-like, growing on dry sands and scrub pine lands.

Leaves & Leaflets: Scrub hickory leaves are 8.2" (range 6-12"; n=4) long with a petiole 1.6-2.8" long covered in coarse hairs. Leaves have 3-7 n=3 leaflets 1.6-4" long by 0.8-1.6" wide. The terminal leaflet is larger than lateral leaflets. The upper leaflets are 3.5-4" long & 1-2" wide, about 2X the size of the lowest pair of leaflets. Scrub hickory lateral leaflets have dense rusty-brown (not red) hairs on their lower sides with amber colored scales. The margins have coarse serrations with no ciliate edges and no small hair tufts on serration teeth. Lateral leaflets have stems (petiolules) 0-0.04" long and terminal leaflets have stems 0-0.2" long.

Buds & Twigs: Scrub hickory terminal buds are hairy, rusty to golden brown colored, densely scaly with amber, yellow to silver scales, and 0.28" (0.1-0.5"; n=6) long. The terminal bud is twice the size of lateral buds. Twigs are slender, densely hairy with reddish brown hairs at growing season start and smooth by the end of the first season.

Fruit & Nuts: Scrub hickory fruit is bronze to dark brown in color and covered with small yellow scales. The husks are rough surfaced, slightly winged, and split easily to the base. Fruit is 1.3" (range 0.75-1.6"; n=4) long and 0.9" (range 0.75-1"; n=4) in diameter. The fruit is rounded and not pear-shaped. Scrub hickory is an abundant fruit producer. The nuts are brown colored with a thick shell and sweet seed.

Periderm: Scrub hickory bark is smooth.

Genetics: Scrub hickory has four sets of chromosomes (tetraploid n= 32). Scrub hickory characters intergrades with *Carya glabra* (pignut hickory) near their range borders.

Notes: Scrub hickory range is central to north-central Florida. Scrub hickory has characteristics of *Carya glabra* except for its leaflets having amber colored resinous glands and scales on the underside. *Carya floridana* and *Carya texana* (black hickory) are closely related species with similarities of micro and macro leaf surface features.

Scientific name: *Carya glabra*.

Year first identified: 1827.

Common name: pignut hickory.

Other common names: sweet pignut hickory, coast pignut hickory, smoothbark hickory, swamp hickory, broom hickory

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Pignut hickory can be a moderate to large tree reaching 74' (range 60-90'; n=6) in height and 1.9' (range 1-2.5'; n=4) in diameter. It usually is found much shorter around 50' in height. Pignut hickory has small, somewhat drooping branches, and an irregular crown. It can be found growing on a diversity of sites ranging from wet to dry – edges of swamps, floodplains, dunes, well-drained sandy soils, and on rolling hills. Pignut hickory is common.

Leaves & Leaflets:

Pignut hickory leaves are 11" (range 6-24"; n=8) long with a petiole 1.2-5.5" long. The petiole and rachis are slender, moderately scaly, not hairy, and green. Leaves have (3)5-7(9) n=5 leaflets which are 5.4" (range 0.8-8.3; n=4) long. The terminal leaflet is larger than lateral leaflets, with the terminal leaflet 4-4.5" long and 5-6" wide. The upper leaflets are 2X - 3X larger compared with the lowest pair of leaflets. Pignut hickory leaflets are smooth to slightly hairy on the underside with no silvery scales, although other colored scales may be present. Occasional axillary tufts of hair are common. Leaflet margins are finely serrate with no ciliate edges and no small tufts of hair on teeth. Leaflets are light green with no rust colored hairs anywhere. Lateral leaflets are directly connected to the rachis (sessile) or nearly so, with lateral leaflet stems (petiolules) 0-0.08" long and terminal leaflet stems 0.08-0.7" long.

Buds & Twigs:

Pignut hickory terminal buds are sparsely scaled, smooth, light brown, tan to reddish-brown, and 0.34" (range 0.1-0.6"; n=8) long. The terminal bud does not have rust-colored hairs, or amber or rusty colored scales. The terminal bud is oval in shape and round in cross-section with 6-8 bud scales. Twigs are slender, smooth, reddish-brown and hairless with pale lenticels.

Fruit & Nut:

Pignut hickory husks are rough, thin, and tan to reddish brown in color with no amber or rusty scales. Fruit sutures are not winged to slightly winged, opening late, and fully or partially closed at maturity. Fruit is 1.2" (range 0.75-1.8"; n=7) long and pear-shaped to round. The nuts are tan with a thick shell and a small, sweet or bitter seed. Seed bitterness is highly variable among individuals and populations.

Periderm:

Pignut hickory bark ranges from tight to having small scales.

Genetics:

Pignut hickory has four sets of chromosomes (tetraploid $n=32$). It hybridizes with: *Carya cordiformis* (*Carya X demareei*); and, *Carya ovalis* (*Carya X* _____). *Carya leiodermis* (swamp hickory) was combined with *Carya glabra* in 1969. Red hickory (*Carya glabra* var. *odorata*, or *Carya ovalis*) has almost the same range as *Carya glabra*, but with husks which split to the fruit base and with shaggy bark. The pignut hickory (*Carya glabra*) / red hickory (*Carya ovalis*) complex causes much tree identification confusion.

Notes:

Pignut hickory (*Carya glabra*) intergrades across the landscape with *Carya floridana* (scrub hickory) to the south, *Carya pallida* (sand hickory) to the north, and *Carya texana* (black hickory) to the west. Pignut hickory has many variants with few of them recognized.

Carya glabra (pignut hickory) and *Carya ovalis* (red hickory) are considered separate species although they have been combined in the past. This complex is usually described as *Carya glabra* individuals growing on sites in valleys, along streams, and more mesic sites, while *Carya ovalis* individuals overlap most of the range with *Carya glabra* but is found on dry, exposed upland hillsides. Because *Carya glabra* and *Carya ovalis* hybridize commonly within their common range, identification is a problem.

Carya glabra var. *megacarpa* (syn. = *Carya austrina*) -- coast pignut hickory has larger fruit, thicker husk, larger leaflets, stouter branches, and larger Winter buds than *Carya glabra*. It is a coastal variety found in the southeastern states from NC to FL, to AL, LA. and inland to central and northern GA and Western MS.

Carya glabra var. *reniformis* (Piedmont pignut) is a variety of pignut hickory with flattened fruit found in the central Piedmont area.

Scientific name: *Carya glabra* var. *megacarpa*.

Common name: Coastal Plain pignut.

Other common names: southern pignut, bigleaf pignut.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Coastal Plain pignut is a medium sized tree 50-70' tall and 2' diameter, although it is usually found at 75% of this size. This Coastal Plain form of the pignut hickory has spreading & drooping branches.

Leaves & Leaflets:

Coastal Plain pignut leaves are 12-14" long with reddish petiole and rachis, holding 5-7 leaflets. The upper leaflets are 8-10" long and 1.5 - 2.5 " wide, 2X larger than the lowest pair of leaflets.

Buds & Twigs:

Coastal Plain pignut hickory terminal bud is around 0.5" long.

Fruit & Nut:

Coastal Plain pignut hickory fruit is covered with bright yellow scales. The fruit is 1-2" long and 1-1.5" in diameter. The fruit is usually pear-shaped. The husk usually remains closed at maturity. The small fruit is sweet.

Periderm:

Coastal Plain pignut hickory bark is smooth and tight.

Notes:

Carya glabra var. *megacarpa* (syn. = *Carya austrina*) Coastal Plain pignut hickory range overlaps the range of *Carya ovalis* (red hickory). Compared to the standard *Carya glabra*, this variety of pignut hickory has: 1.5-1.75X larger leaves; larger leaflets; 1.75X thicker fruit husks; larger fruit; stouter twigs; larger Winter buds; and, 1.5-2.0X larger terminal leaflets. Pignut hickory (*Carya glabra*) is considered a more northern species and this variety a more southern variety. This coastal variety is found in the southeastern states from NC to FL, to AL, LA. and inland to central and northern GA and Western MS.

Carya glabra var *megacarpa*, *Carya glabra* var. *magnifloridana*, and *Carya glabra* var. *leioderms*, all with tight bark and pear-shaped fruit which does not split, are found along the Gulf coast and Atlantic coastal plain.

#1 Scientific name: *Carya illinoensis* (accepted spelling)

#2 Scientific name: *Carya illinoensis*

(considered a deviant spelling – but is found in some USDA Forest Service works)

NOT NATIVE – NATURALIZED – native in lower Mississippi Valley area.

Year first identified: 1869.

Common name: pecan.

Other common names: sweet pecan, pecanier, nogal morado, nuez encarcelada.

Carya genera section: Section A (*Apocarya*), the pecan hickories.

Tree & Site:

Pecan is a well known and cultivated tree. Its largest expected size within its home range is 120' (range 100-160"; n=6) tall and 4.5' (3-7'; n=4) in diameter. The usual size for non-plantation / non-cultivar trees is 85' in height. Pecan has a broad rounded crown with heavy branches, buttressed base, and a clear trunk. It can be found growing in bottomlands, wet but well-drained soils, river valleys, and on rich soils. There have been many cultivars developed for fruit, nut, and seed characters. Commercial nut production plantations can be found in many locations outside pecan's native range. This species has been moved by humans and planted over at least the last 600 years, and has now escaped and become naturalized in many areas.

Leaves & Leaflets:

Pecan leaves are 17" (range 12-24"; n=6) long with (7)11-17(21) leaflets. Leaflets are 4.9" (range 0.8-8"; n=8) long. The terminal leaflet is equal in size to lateral leaflets. Pecan leaflets have a yellow mid-vein and a serrated margin. Leaflets are yellow-green above, and paler and slightly hairy and scaly below. Lateral leaflet stems (petiolules) are 0-0.3" long and terminal leaflets are 0.2-1" long.

Buds & Twigs:

Pecan terminal buds are yellow brown, rusty brown to black, elongated and flattened in cross-section with 4-6 bud scales, and 0.4" (range 0.2-0.5"; n=4) long. The terminal bud is covered in clusters of yellow hairs, but with no silvery scales. Twigs are slender to stout, hairy and scaly with noticeable oblong orange lenticels.

Fruit & Nut:

Pecan fruits are dark brown and covered in yellow scales. Fruit sutures are not winged to slightly winged, opening late, and fully or partially closed at maturity. Fruit are in clusters of 3-12 on twigs with the fruit 1.7" (range 1-2.5"; n=8) long and 0.8" (range 0.5-1.2"; n=4) in diameter. The husk surface is rough and thin, splitting to nearly its base at maturity. The nut is bright light reddish brown in color with a thin smooth shell and a round cross-section with a sweet nut.

Periderm:

Pecan bark is scaly with small plates.

Genetics:

Pecan has two sets of chromosomes (diploid $n=16$). It hybridizes with: *Carya aquatica* (*Carya X lecontei*); *Carya cordiformis* (*Carya X brownii*); *Carya laciniosa* (*Carya X nussbaumeri*); *Carya ovata* (*Carya X* _____); and, *Carya tomentosa* (*Carya X schneckii*).

Bitter hickory (*Carya X lecontei*) is a natural hybrid between *Carya illinoensis* (pecan) X *Carya aquatica* (water hickory) and is a large tree of swamps, wetlands, and bottomland along the Gulf coastal plain, but is not found in Georgia.

Pecan is closely related to black hickory (*Carya texana*).

Notes:

Pecan is native to the middle and southern Mississippi river valley, the lower Ohio river valley, and west into Texas and Oklahoma. Many cultivars have been developed for plantation nut production and are usually much smaller in stature than native trees. Wild-types and cultivars have been moved, planted widely, and escaped cultivation, and have been naturalized across a much wider area than its original native range.

Scientific name: *Carya laciniosa*.

Year first identified: 1830

Common name: shellbark hickory.

Other common names: kingnut hickory, big shellbark hickory, big shagbark hickory, bigleaf shagbark hickory, bottom shellbark hickory, thick shellbark hickory, western shellbark hickory.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Shellbark hickory is a large tree reaching 110' (range 70-150'; n=4) tall and 2.9' (range 2.5-3.3'; n=3) in diameter. It is usually found as a 80' tall mature tree. Shellbark hickory has a slender, grey to light-tan colored, self-pruned stem with a narrow, rounded crown. It is a rare hickory with slow growth, but is long-lived. It is found growing in bottomlands, floodplains, river valleys, and on moist slopes.

Leaves & Leaflets:

Shellbark hickory leaves are large, 20" (range 12-31"; n=9) long with a 2.4" - 5.1" long petiole which is minutely hairy along the rachis. The rachis persists on the tree into winter. The leaves have (5)7-9(11) n=7 leaflets which are 5.4" (range 2-8"; n=6) long. The terminal leaflet is significantly larger than lateral leaflets. The upper leaflets are 5-9" long and 3-5" wide usually 2X - 3X larger than the lowest pair of leaflets. Shellbark hickory leaflets are shiny dark green above with an underside which has soft hairs and a pale yellow-green to bronzy brown color. Leaflet serration margins are not ciliate and without tufts of hair on teeth. Lateral leaflet stems (petiolules) are 0-0.4" long and terminal leaflet stems are 0.8-5.5" long.

Buds & Twigs:

Shellbark hickory terminal bud is tan to brown in color, very hairy, oval shaped, and round in cross-section with 11-12 bud scales. The terminal bud is 0.88" (range 0.5-1.5"; n=9) long. Twigs are stout, pale orange to orange-tan in color and hairy with noticeable lenticels.

Fruit & Nut:

Shellbark hickory fruit is solitary or in pairs, with a husk which is light orange-brown to chestnut-brown in color at maturity, minutely hairy, thick, and nearly round. Fruit sutures are not winged and split to its base at maturity. Fruit is 2" (range 1.5-2.8"; n=10) long and 1.7" (range 1.25-2"; n=4) in diameter. The nut is 1.8" (range 1.2-2.4"; n=6) long, with a thick, hard shell. The nut is very large with a sweet, chestnut brown seed.

Periderm:

Shellbark hickory bark is shaggy to very shaggy.

Genetics:

Shellbark hickory has two sets of chromosomes (diploid n=16). It hybridizes with: *Carya cordiformis* (*Carya* X _____); *Carya illinoensis* (*Carya* X *nussbaumeri*); and, *Carya ovata* (*Carya* X *dunbarii*). Shellbark hickory has the largest leaves and nuts of any native hickory.

#1 Scientific name: *Carya myristicaeformis*

#2 Scientific name: *Carya myristiciformis* (alternative spelling)

Year first identified: 1818 -- confirmed as species in 1971.

Common name: nutmeg hickory.

Other common names: swamp hickory, bitter water hickory, nogal.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site: Nutmeg hickory can be a large tree reaching a height of 100' (range 80-115'; n=4) and a diameter of 2.2'. It is usually seen with a height of 60'. Nutmeg hickory has a stout and straight trunk, an open crown, and slender branches coated with shiny golden-brown scales. It is found growing on flood plains, bottomlands, moist hillsides, and poorly drained sites along streams and in swamps.

Leaves & Leaflets: Nutmeg hickory leaves are 12.9" (range 7-20"; n=4) long with a petiole 1.2-4" long. The petiole and rachis is scurfy, scaly, and hairy. Leaves have (5)7-9 leaflets 4.2" (range 1.2-6.7"; n=4) long and 1.5" (range 0.4-3.2"; n=4) wide. The terminal leaflet is equal in size to lateral leaflets. Nutmeg hickory leaves have a metallic silver to bronze sheen. Leaflet undersides are densely hairy but lustrous, whitish in color with metallic silver to bronze scales. The mid-vein is hairy. Lateral leaflets stems (petiolules) are 0-0.08" long with terminal leaflet stems 0.08-0.1" long.

Buds & Twigs: Nutmeg hickory terminal bud is bronze color, with densely silvery scales, and occasional yellow-brown hairs (but considered mostly hairless). The terminal bud is 0.23" (range 0.15-0.4"; n=4) long, oval in shape, and round in cross-section with 6-15 bud scales. All buds can have silver, amber, or bronze colored scales. Twigs are slender with no hairs but are densely scaly with small yellowish to brownish scales. Nutmeg hickory buds and twigs can all have a metallic silver to bronze sheen due to scales.

Fruit & Nut: Nutmeg hickory fruit is solitary with a rough husk covered in yellow-brown hairs. Fruit sutures are winged (keeled) and splits to its base at maturity. Fruit is 1.1" (range 0.8-1.5"; n=4) long and 0.7" (range 0.6-0.8"; n=2) in diameter. The nut shell is thick and smooth with a circular cross-section. The small seed is sweet.

Periderm: Nutmeg hickory bark texture is shaggy to large platey scales.

Genetics: Nutmeg hickory has two sets of chromosomes (diploid n=16).

Notes: Nutmeg hickory is the rarest hickory species in Georgia and across the southeast with a localized and patchy distribution across the upper Coastal Plain. General range includes eastern SC, central AL, north MS, central AR, west LA, southeast OK, and east TX. Although native habitats are present and one old confirmed collection citation in the state was made, individual trees elude discovery in Georgia. Discovery of this species in the upper Coastal Plain remains a dendrological priority.

Scientific name: *Carya ovalis*.

Year first identified: 1913.

Common name: red hickory.

Other common names: pignut hickory, sweet pignut hickory, sweet hickory, oval pignut hickory, false shagbark hickory, false pignut hickory.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Red hickory can be a large tree 100' tall and 3' in diameter. It is usually seen at half this size around 50' tall. This tree is a rarely noticed hickory with a range overlapping with, and sometimes mistaken for, *Carya glabra* (pignut hickory). Red hickory can be found in upland woodlands and higher elevations away from the coast.

Leaves & Leaflets:

Red hickory leaves are 8" (6-10") long with a petiole which is reddish colored, slender and scurfy with scales. The leaves have (5)7 leaflets. The upper leaflets are 3-7" long and 1.5 - 2" wide. Red hickory leaflet undersides are hairy with concentrated axillary tufts of hair. The upper surface is smooth. Terminal leaflet stems (petiolules) are 0.25 - 0.5" long and lateral leaflets are directly on the rachis (sessile).

Buds & Twigs:

Red hickory terminal bud is red-brown in color, smooth, and 0.5" long, which is roughly twice the size of lateral buds. Terminal buds are oval in shape and round in cross-section with 6-15 scales. Twigs are slender and red-brown in color.

Fruit & Nut:

Red hickory fruit is elliptical with husk sutures not winged, and splitting easily the full length at maturity along at least two sutures. The fruit is 1 - 1.25" long and 0.75" in diameter. Seeds are small and sweet.

Periderm:

Red hickory bark is tight to small platey scales.

Genetics:

Red hickory has four sets of chromosomes (tetraploid $n=32$). The potential pignut hickory (*Carya glabra*) and red hickory (*Carya ovalis*) complex system generates much confusion for identification of individuals.

Several varieties have been defined but few have been accepted, for example:

Carya ovalis var. *hirsuta* (hairy red hickory) found in the southern Appalachian Mountains.

Carya ovalis var. *microcarpa* is a small fruited variety in northwest GA stretching from the Atlanta area. It is called the "small fruit red hickory;"

Carya ovalis var. *obcordata* has a round, slightly winged fruit in central and eastern GA, and found widely in western NC, eastern MS, and central AL in more hilly and mountainous terrain. It is called the “northern red hickory;”

Carya ovalis var. *obovalis* is found widely in coastal Georgia and North into NC mountains and from New England across to Missouri down to north-central AL. It is called the “peanut red hickory;” and,

Carya ovalis var. *odorata* found in Atlanta, GA and North. *Carya ovalis* was once considered variety of pignut hickory (*Carya glabra* var. *odorata*).

Some authors have suggested *Carya ovalis* is an intra-genus hybrid between pignut hickory (*Carya glabra*) and shagbark hickory (*Carya ovata*), but there is no concrete evidence.

Notes:

Red hickory range is the same as pignut hickory (*Carya glabra*) range, but expanded to west and southeast MO, northeast OK, northern AR, and south to LA. This species is not common in the Coastal Plain region, but tends to be found in central and north GA.

Carya glabra (pignut hickory) and *Carya ovalis* (red hickory) are considered separate species although they have been combined in the past. This complex is usually described as *Carya glabra* growing on sites in valleys, along streams, and more mesic sites, while *Carya ovalis* overlaps most of the range with *Carya glabra* but is found on dry, exposed upland hillsides. Because *Carya glabra* and *Carya ovalis* hybridize commonly within their common ranges, identification and differentiation problems are significant.

Scientific name: *Carya ovata*.

Year first identified: 1869.

Common name: shagbark hickory.

Other common names: shellbark hickory, scalybark hickory, upland hickory, noyer tendre, caryer ovale.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Shagbark hickory is a large tree, 95'(range 70-150'; n=5) tall and 3.5' (range 3-5'; n=4) in diameter. It is most commonly seen with a height of 65'. Shagbark hickory self-prunes well, leaving a tall clear dark reddish-brown stem with a few stout branches forming an irregular narrow crown. It is noticeably slow growing. It can be found on rich side-slope soils, rocky hillsides, and moist but well drained soils in valleys. It is not usually found in the lower Coastal Plain.

Leaves & Leaflets:

Shagbark hickory leaves are 12.5" (range 8-20"; n=6) long, with a stout hairy petiole 1.6-5.1" long. Leaves have 5(7) leaflets which are 5.5" (range 1.6-10.2"; n=4) long. The terminal leaflet is 5-7" long and 2-6" wide, usually 1.5X - 3X larger than lower leaflets. Shagbark hickory leaflets are finely serrated with margins thickly lined with ciliate, and leaflet teeth bearing small hair tufts. Leaflets are smooth above and yellow-green in color, and paler below with scattered tufts of hair. Lateral leaflet stem (petiolules) are 0-0.04" long and terminal leaflet stems are 0.1-0.7" long. Crushed leaflets smell like sliced apples.

Buds & Twigs:

Shagbark hickory terminal bud is long and hairy, chestnut brown to blackish in color, and 0.5" (range 0.2-0.75"; n=6) long. The terminal bud is oval shaped and round in cross-section with 6-15 bud scales. Twigs are greenish, reddish, or orange-brown in color with elongated pale lenticels. Twigs have no scales and becoming darker reddish brown as the season progresses. Twigs are stout and 0.1-0.25" in diameter.

Fruit & Nut:

Shagbark hickory fruit occurs in pairs or as singles. The husk is rough, thick, and dark reddish-brown to black at maturity. Fruit is 1.3" (range 1-2.5"; n=11) long and nearly round. Fruit sutures are not winged and split to the base at maturity. Nuts are thick shelled with a sweet, aromatic seed.

Periderm:

Shagbark hickory bark is shaggy.

Genetics:

Shagbark hickory has two sets of chromosomes (diploid n=16). It hybridizes with: *Carya cordiformis* (*Carya* X *laneyi*); *Carya illinoensis* (*Carya* X _____); and, *Carya laciniosa* (*Carya* X *dunbarii*).

Notes:

Shagbark hickory has several varieties cited, mostly concentrated along the northern and western range of the species.

Carya ovata var. *australis* (*Carya carolinae-septentrionalis*) or southern shagbark hickory has more slender twigs, darker outer bud scales, and grows on sites with thinner soils and higher pH than shagbark hickory.

Carya ovata var. *pubescens* (bottomland shagbark hickory) has tufts of hair on tips of leaflet serrations and extremely dense rusty brown pubescence of pale tricombs on young twigs, petioles, rachis, and covering the undersurface of leaflets. This hickory has slender branches, and small buds. It can be mistaken for *Carya tomentosa* (mockernut hickory). It is found along the Savannah River and Little River valleys in northern Georgia, and in TN, AL, MS.

Scientific name: *Carya pallida*.

Year first identified: 1902.

Common name: sand hickory.

Other common names: pale hickory, pallid hickory, pignut hickory.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site:

Sand hickory can be a large tree with a 95' (range 80-115'; n=5) height and a 3' (range 2.5-3.3'; n=3) diameter. It is usually found with a height of 45' and an 1.6' diameter. Sand hickory has upper branches which are stiff, stout and upright, and with lower branches more pendulous. It is found growing in dry upland woodlands, on bluffs and ridge tops, and well-drained sandy to rocky soils. Sand hickory has a large range but is not common.

Leaves & Leaflets:

Sand hickory leaves are 14" (range 7-24"; n=4) long, with a slender petiole 1.2-4" long and a rachis densely covered in hairs and scales. Leaves have (5)7(9) leaflets which are 4.2" (range 0.8-6"; n=4) long and 1.5" (range 0.4-2.4"; n=4) wide. The terminal leaflet is larger than lateral leaflets with leaflet pairs all roughly the same size except for the lowest pair which is <2" long and 0.5" wide. Sand hickory leaflets have dense silvery-tan to amber scales. Leaflets are especially pale below with a hairy surface of small silvery to silvery-yellow scales, and with axillary hairs. Leaflet undersides are dull and tan-yellow or rusty brown in color. The mid-vein is hairy especially near the base. Leaflet margins bear no ciliate edges and no hair tufts on serration teeth. Lateral leaflets stems (petiolules) are 0-0.04" long and terminal leaflet stems are 0.8-2" long.

Buds & Twigs:

Sand hickory terminal bud is reddish-brown in color, covered in hairs, with dense silvery, amber, or rusty scales, and is 0.3" (range 0.2-0.5"; n=7) long. The terminal bud is oval in shape and round in cross-section with 6-9 bud scales covered in silvery scales. The buds and twigs are silvery tan to rusty-reddish brown in color. Twigs are slender and slightly scaly.

Fruit & Nut:

Sand hickory fruit is tan to reddish-brown with a thin husk which has a scruffy rough surface and hairy with dense amber yellow, silvery or rusty scales. The fruit is 1.1" (range 0.5-2"; n=10) long. Husk surface is smooth, and sutures are not winged splitting from 75% to full length at maturity. The nuts are tan and thin shelled with a small white sweet seed.

Periderm:

Sand hickory bark is tight, ridged & furrowed.

Genetics:

Sand hickory has four sets of chromosomes (tetraploid n=32). It hybridizes with *Carya glabra* (*Carya* X ____). Sand hickory overlaps and intergrades with black hickory (*Carya texana*) in the western part of its range.

Notes:

Sand hickory range is found primarily east of the Mississippi river, with some individuals growing westward with *Carya texana* (black hickory) individuals along their northern species range in river valleys. Generally the range of sand hickory is along the Coastal Plain from southern NJ and DE, to GA, northwest and western FL, to southeast LA, Mississippi valley to TN, southeast KY, southern IL, and southwest IN.

Carya pallida (sand hickory) is usually identified by dense hair tufts on rachis and leaflet midveins, silvery scales on the lower leaflet surfaces, slender twigs, and small terminal buds with reddish brown bud scales.

Scientific name: *Carya texana*.

NOT NATIVE – native farther West

Year first identified: 1860.

Common name: black hickory.

Other common names: Buckley hickory, pignut hickory.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site: Black hickory can be a large tree of 100' tall and 3' in diameter. It is usually found much smaller at 30' tall and 10" in diameter, and is almost always found as a small tree. It is found growing in a variety of sites including bottomlands, well-drained sandy soils, in valley bottoms, and on rolling hills, sand hills, and rocky ridges.

Leaves & Leaflets: Black hickory leaves are 11.5" (range 8-17"; n=4) long with petioles 1.2-3.2" long. The petiole and rachis have scattered tufts of rust-colored hairs. Leaves have 5-7 leaflets which are 3.8" (range 1.2-6"; n=4) long and 1.7" (range 0.4-3.2"; n=3) wide. The terminal leaflet is larger than lateral leaflets. Black hickory leaflet undersides have scattered tufts of coarse rust colored hairs and dense small rusty-brown scales. The leaflet midveins are very hairy. There are no amber colored or silvery scales below, just reddish hairs. The upper side of leaflets are smooth but scaly. Leaflet margins are serrated with no ciliate on teeth edges and no tufts of hair on teeth. Lateral leaflet stems (petiolules) are 0-0.04" long and terminal leaflet stems are 0.08-0.4" long.

Buds & Twigs: Black hickory terminal bud is reddish brown in color, with tufts of rust to rusty-brown colored hairs and densely scaly with rusty brown colored scales, but with no silvery scales. Terminal buds are 0.3" (range 0.2-0.5"; n=5) long. Twigs are slender, with rust colored tufts of hair, densely scaly, with bright red-brown to rusty coloration, and pale lenticels.

Fruit & Nut: Black hickory fruit is bronze to reddish-brown in color with small rusty brown scales. Fruit is 1.7" (range 1.2-2"; n=4) long and 1-1.4" in diameter. The fruit husk is thick, with slightly winged sutures splitting almost to its base at maturity. The seed is bright reddish-brown in color and ranging from very bitter to sweet. Seed sweetness is highly variable, depending upon population and location.

Periderm: Black hickory bark is rough, black in color, tight, and ridged and deeply furrowed.

Genetics: Black hickory has four sets of chromosomes (tetraploid n=32). It hybridizes with: *Carya aquatica* (*Carya* X *ludoviciana*); *Carya cordiformis* (*Carya* X _____); *Carya glabra* (*Carya* X _____); and, *Carya tomentosa* (*Carya* X *collina*). Black hickory individuals intergrade with *Carya pallida* individuals in eastern MO and southern IL.

Notes: Black hickory range is concentrated primarily west of the Mississippi river.

Carya floridana (scrub hickory) and *Carya texana* are closely related species as supported by micro and macro leaf surface features.

Scientific name: *Carya tomentosa*.

Year first identified: 1818.

Common name: mockernut hickory.

Other common names: white hickory, whiteheart hickory, hognut, bullnut.

Carya genera section: Section C (*Carya*), the true hickories.

Tree & Site: Mockernut hickory is a moderate to large tree reaching 84' (range 50-115'; n=4) tall and 3' (range 2-4'; n=3) in diameter. It is usually found with a mature height of 60' and diameter of 21". It has a narrow rounded crown of rigid, stout branches. Mockernut hickory grows on moist upland, well-drained soils, hillsides, and along ridges. It is a common species and wide-spread.

Leaves & Leaflets: Mockernut hickory leaves are 12.5" (range 8-20"; n=8) long with densely hairy and scaly petiole and rachis. Petiole is 1.2-4.7" long. Leaves have (5)7-9 leaflets which are 5.4" (range 1.6-8"; n=6) long and 2.2" (range 0.8-3.2"; n=4) wide. The upper leaflet pairs are 2X-3X larger than lowest leaflet pair. Mockernut hickory leaflets are finely serrated, shiny dark yellow-green above and paler with very dense, long, matted, curly hairs below. Leaflet margins do not have ciliate edges and no hair tufts on teeth. Lateral leaflet stems (petiolules) are 0-0.08" long and terminal leaflet stems are 0.08-0.1" long. Crushed leaflets are very aromatic and smell like a "gin-n-tonic" drink.

Buds & Twigs: Mockernut hickory terminal buds have 3-4 outer bud scales which are dark reddish brown to tan. The terminal bud is 0.6" (range 0.3-0.8"; n=8) long. The terminal bud is oval in shape and round in cross-section. All buds are hairy, lacking any silvery or amber yellow colored scales. Twigs are stout, hairy, with reddish-brown scales and many lenticels.

Fruit & Nut: Mockernut hickory fruit husk is thick, smooth, and dark red-brown. The fruit sutures are not winged, splitting from 75% to full length of the husk at maturity. The fruit is 1.6" (range 1-2"; n=10) long and nearly round. The nut is 1-1.4" long, tan in color with a thick shell surrounding a small sweet seed, which is dark brown in color.

Periderm: Mockernut hickory bark is tight & irregularly furrowed.

Genetics: Mockernut hickory has four sets of chromosomes (tetraploid n=32). It hybridizes with: *Carya illinoensis* (*Carya X schneckii*); *Carya ovata* (*Carya X* _____); and, *Carya texana* (*Carya X* _____).

Notes: Mockernut hickory is considered the most abundant hickory species in Georgia, and most common across the southeastern United States. Both shagbark hickory (*Carya ovata*) and mockernut hickory (*Carya tomentosa*) were historically clumped together as the same species, and first described as *Juglans alba* and then *Carya alba*. This species name has been rejected.

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<u>Scientific Name</u> (Scientific Name Synonyms)	<u>Common Name</u>	<u>Genus</u> <u>Section</u>
<i>Carya aquatica</i> Carya aquatica var. australis Carya integrifolia	water hickory	A
<i>Carya carolinae-septentrionalis</i> Carya ovata var. australis Carya ovata var. carolinae-septentrionalis	southern shagbark hickory	C
<i>Carya cordiformis</i> Carya amara Carya cordiformis var. latifolia	bitternut hickory	A
<i>Carya floridana</i> **	scrub hickory	C
<i>Carya glabra</i> Carya amara var. porcina Carya glabra var. hirsuta Carya glabra var. megacarpa Carya leiodermis Carya megacarpa Carya magnifloridana Carya microcarpa Carya ovalis var. hirsuta Carya X ovalis var. hirsuta Carya pecan Carya porcina	pignut hickory	C
<i>Carya illinoensis</i> Carya angustifolia Carya diguetii Carya illinoensis Carya olivaeformis Carya oliviformis Carya pecan Carya tetraptera	pecan	A
<i>Carya laciniosa</i> Carya sulcata	shellbark hickory	C
<i>Carya myristiciformis</i> Carya fernowiana	nutmeg hickory	~AC

**** = non-native to Georgia**

Figure 1: Native and naturalized hickory species of Georgia and surrounding states with past associated scientific names, common names, and genus section. (continued)

Not included are historic genus names *Hicoria* and *Juglans*.

(A = *Apocarya* -- pecan hickories; C = *Carya* -- true hickories).

<u>Scientific Name</u> (Scientific Name Synonyms)	<u>Common Name</u>	<u>Genus</u> <u>Section</u>
Carya ovalis Carya alba var. ovalis Carya borealis Carya glabra var. odorata Carya leiodermis Carya microcarpa Carya ovalis var. hirsuta Carya ovalis var. mollis Carya ovalis var. obcordata Carya ovalis var. obovalis Carya ovalis var. odorata Carya X ovalis var. odorata	red hickory	C
Carya ovata Carya alba Carya australis Carya carolinae-septentrionalis Carya ovata var. fraxinifolia Carya ovata var. nuttallii Carya ovata var. pubescens	shagbark hickory	C
Carya pallida	sand hickory	C
Carya texana ** Carya arkansana Carya buckleyi Carya buckleyi var. arkansana Carya glabra var. villosa Carya texana var. arkansana Carya texana var. villosa Carya villosa	black hickory	C
Carya tomentosa Carya alba Carya tomentosa var. subcoriacea	mockernut hickory	C

**** = non-native to Georgia**

Figure 1: Native and naturalized hickory species of Georgia and surrounding states with past associated scientific names, common names, and genus section. (continued)

Not included are historic genus names *Hicoria* and *Juglans*.

(A = *Apocarya* -- pecan hickories; C = *Carya* -- true hickories).

Key Identifying Macro-Features of *Carya* Species

deciduous
leaves odd-pinnately compound & alternately attached
no leaf stipules
leaflets 3-17 & serrated (rarely entire)
smooth leaflet surfaces not wrinkled or rough

terminal bud prominent
buds with bud scales (either valvate or imbricate)
pith solid

monoecious
flowers appear with the leaves
male catkins dangling in clusters of 3-8
no male flower sepals
female flowers / catkins erect

fruit are large nuts with husks
husk slightly to strongly splitting along 4 ridges
nut shell woody & smooth to somewhat wrinkled
seed is fleshy with hypogeal germination

ring porous annual xylem increments
vessel pores round

base chromosome number $n=16$
contains both diploid and tetraploid species

Figure 2: Key identifying macro-features of *Carya* genus.
(Manning 1978; Manos & Stone 2001)

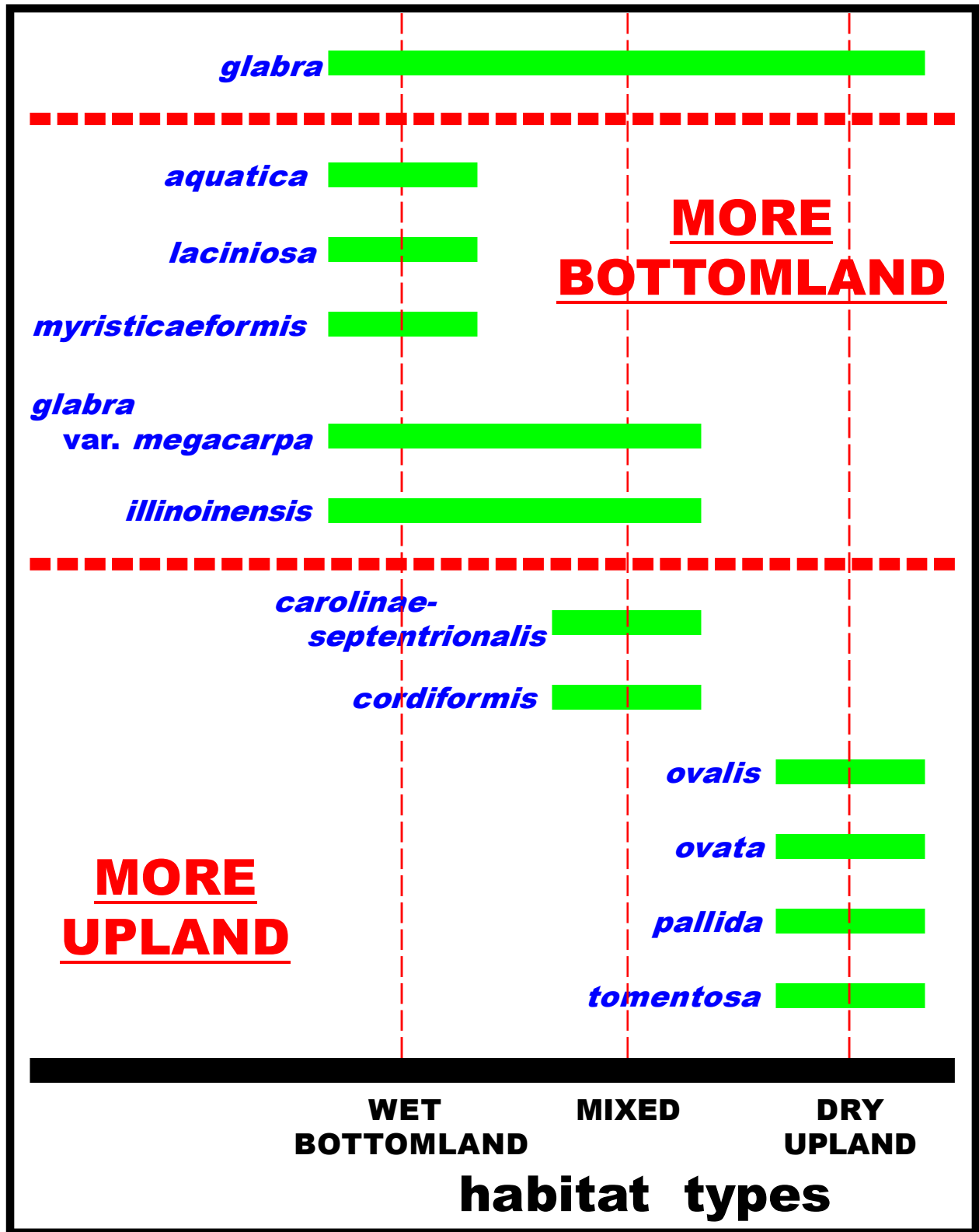


Figure 3: Moisture regime and growth habitats for native / naturalized hickories, listed by scientific species name.

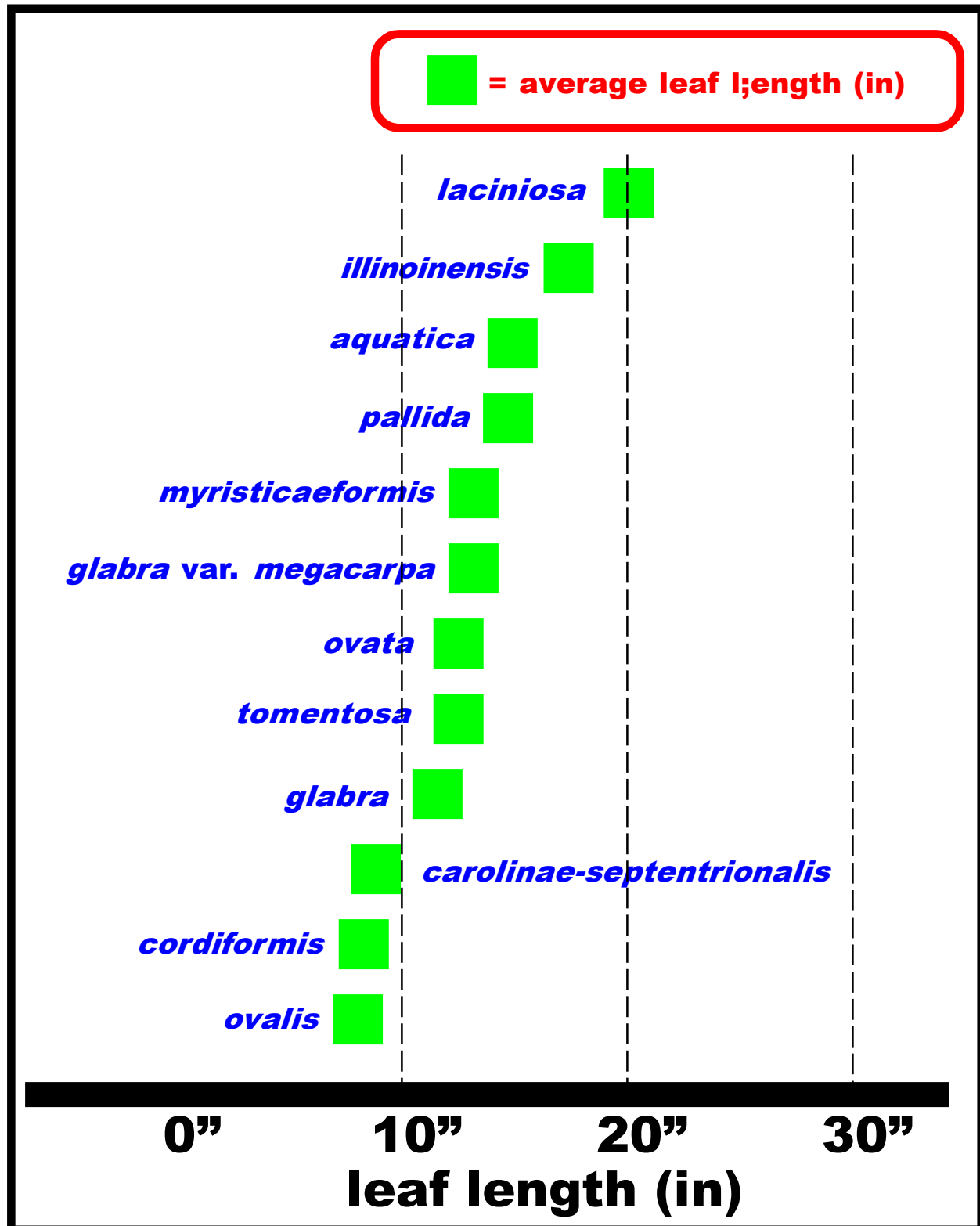


Figure 4: Average leaf lengths in inches for native / naturalized hickories, listed by species scientific name.

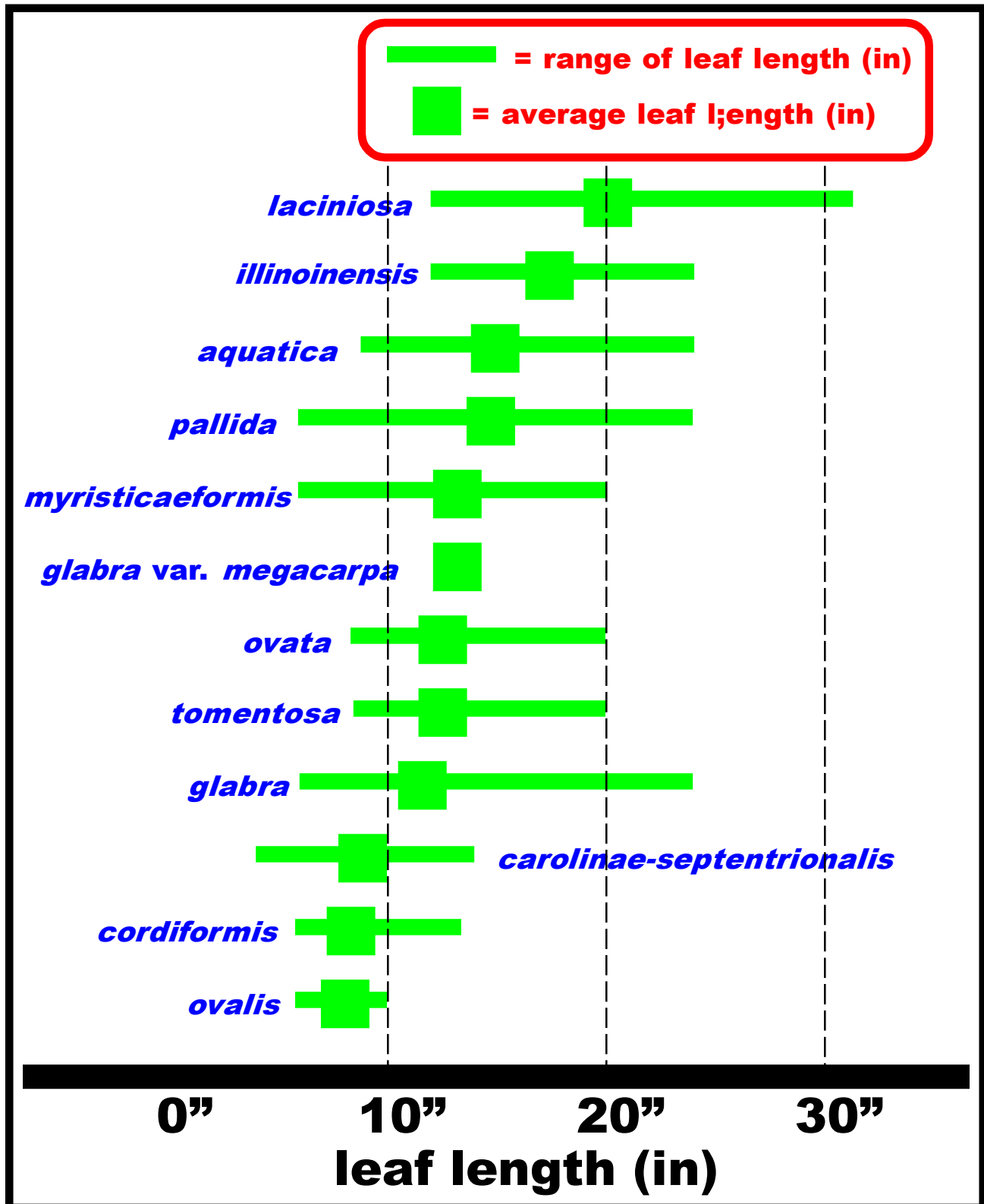


Figure 5: Leaf lengths in inches for native / naturalized hickories, listed by species scientific name. Note overlap of leaf lengths.

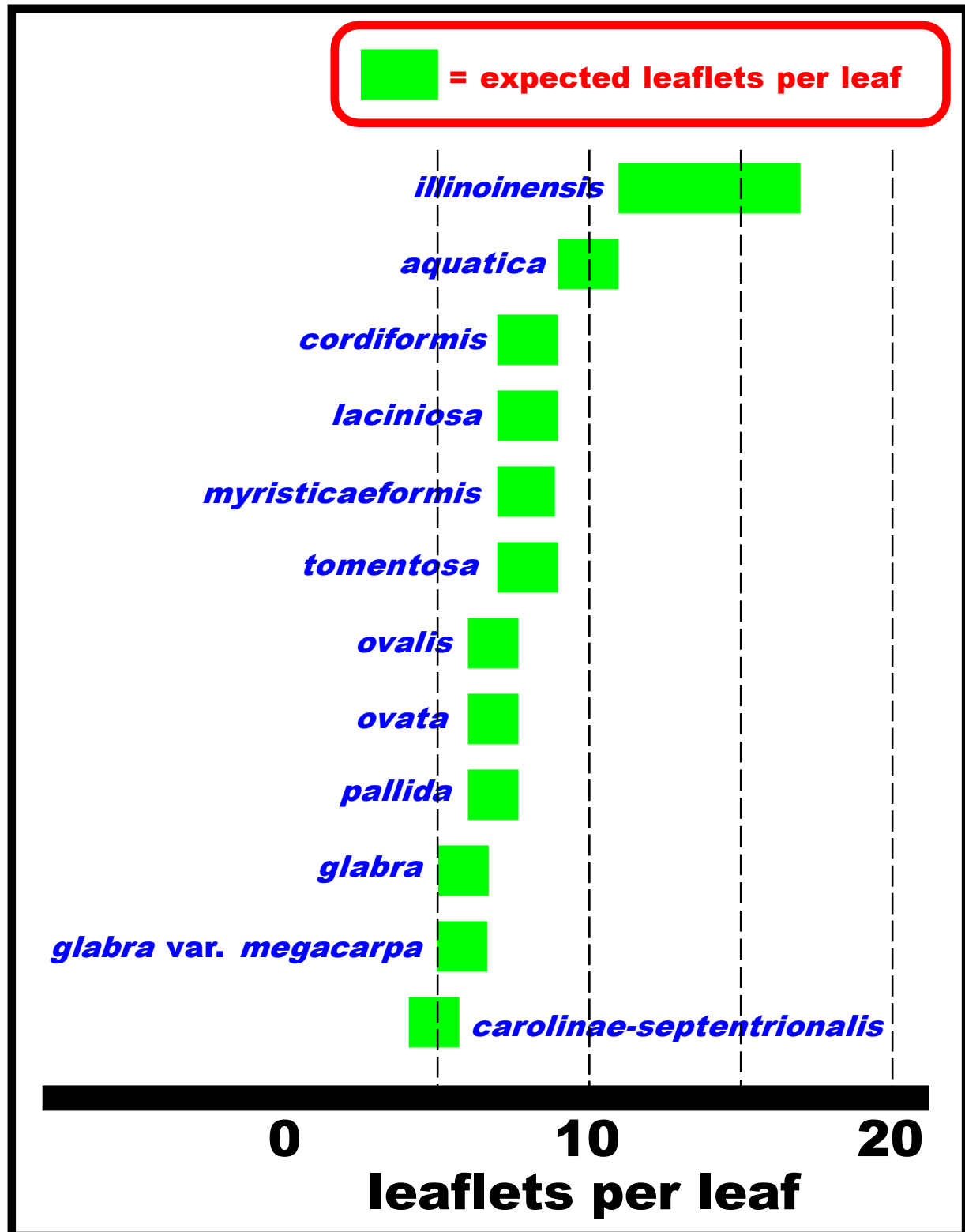


Figure 6: Expected number of leaflets per leaf for native / naturalized hickories, listed by species scientific name.

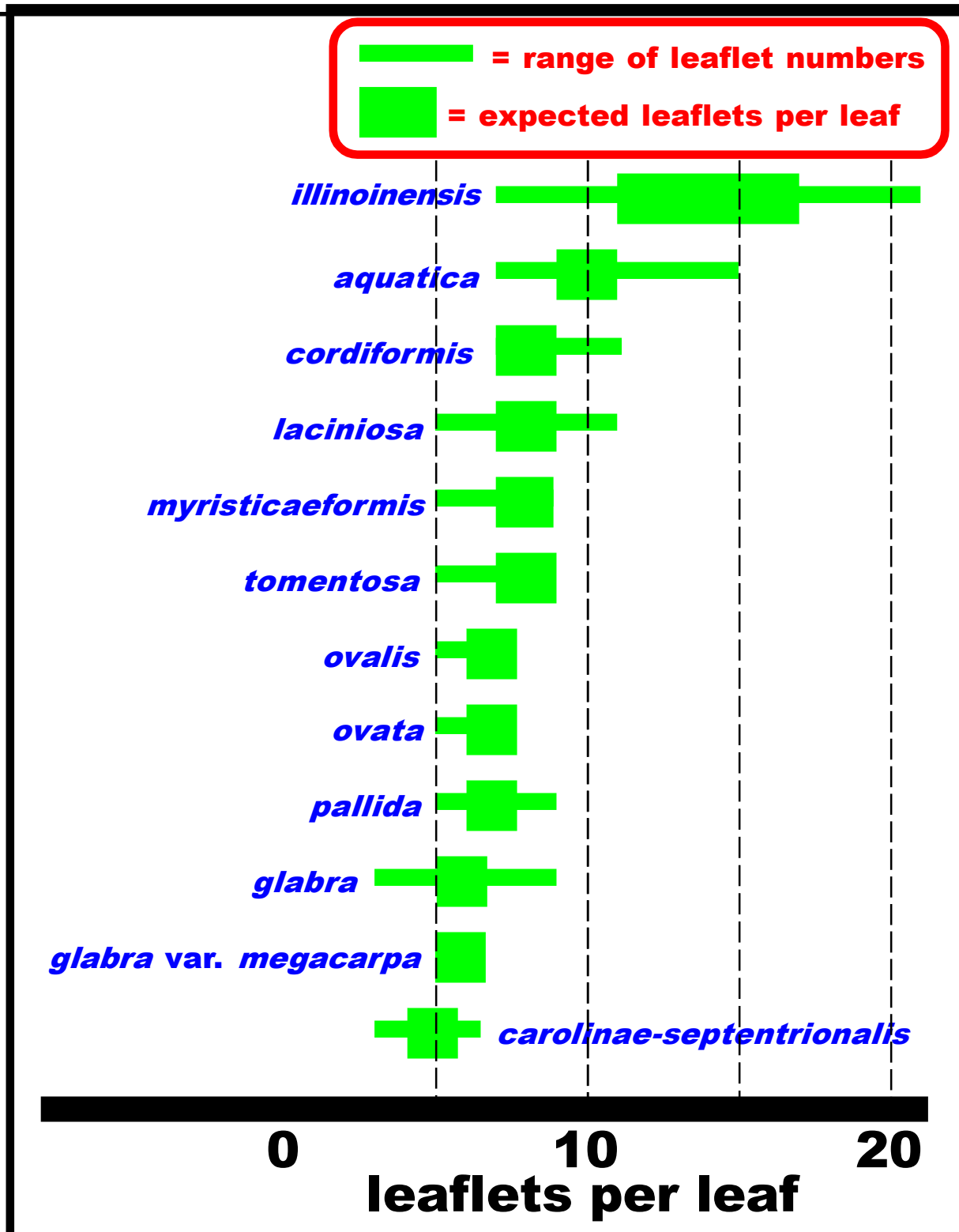


Figure 7: Number of leaflets expected and full range of leaflets cited per leaf for native / naturalized hickories, listed by scientific name. Note overlap in leaflet number per leaf.

HICKORY LEAF

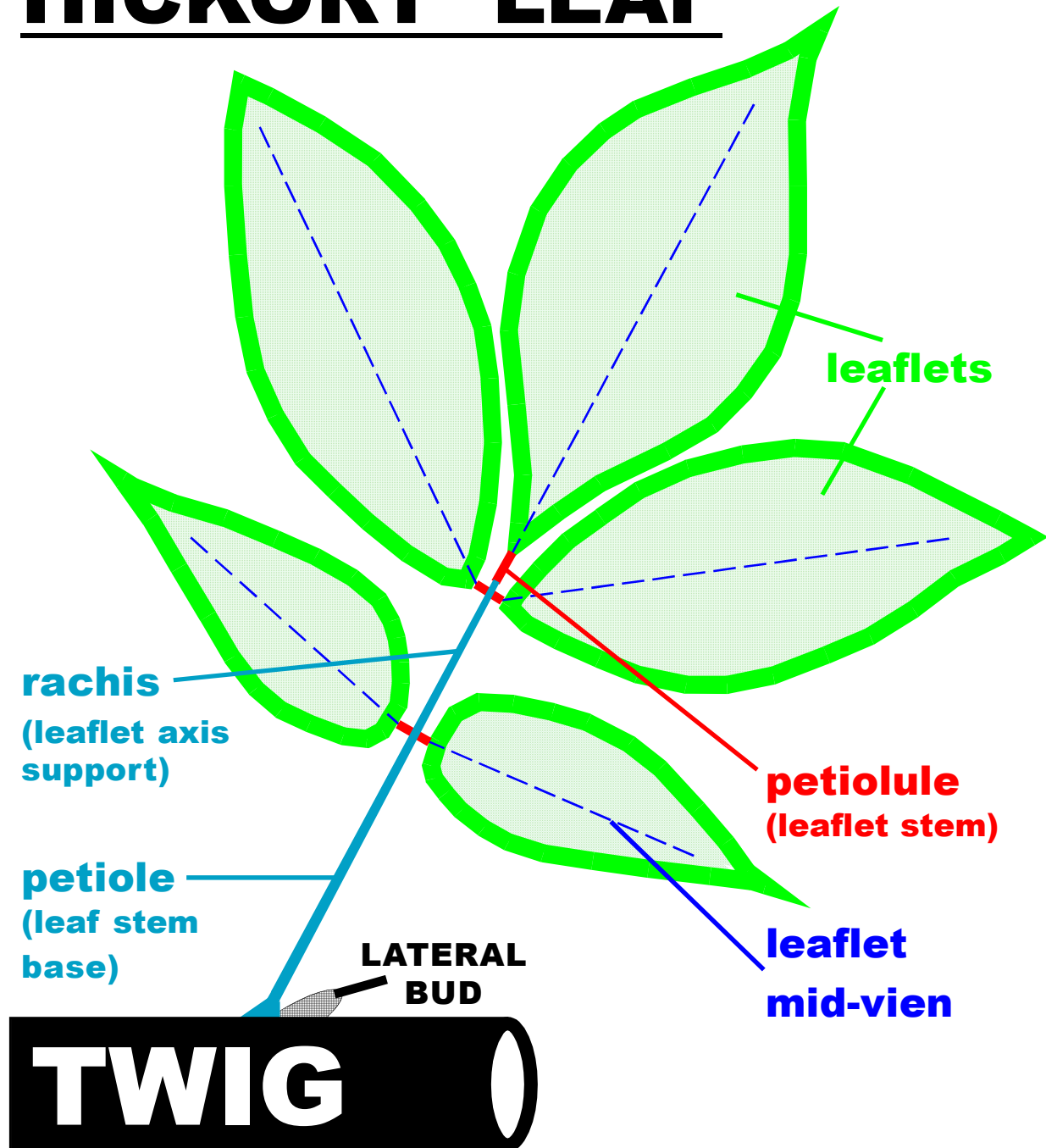


Figure 8: A idealized single *Carya ovata* (shagbark hickory) leaf with five leaflets.

Note serrations on leaflet edges are not shown.

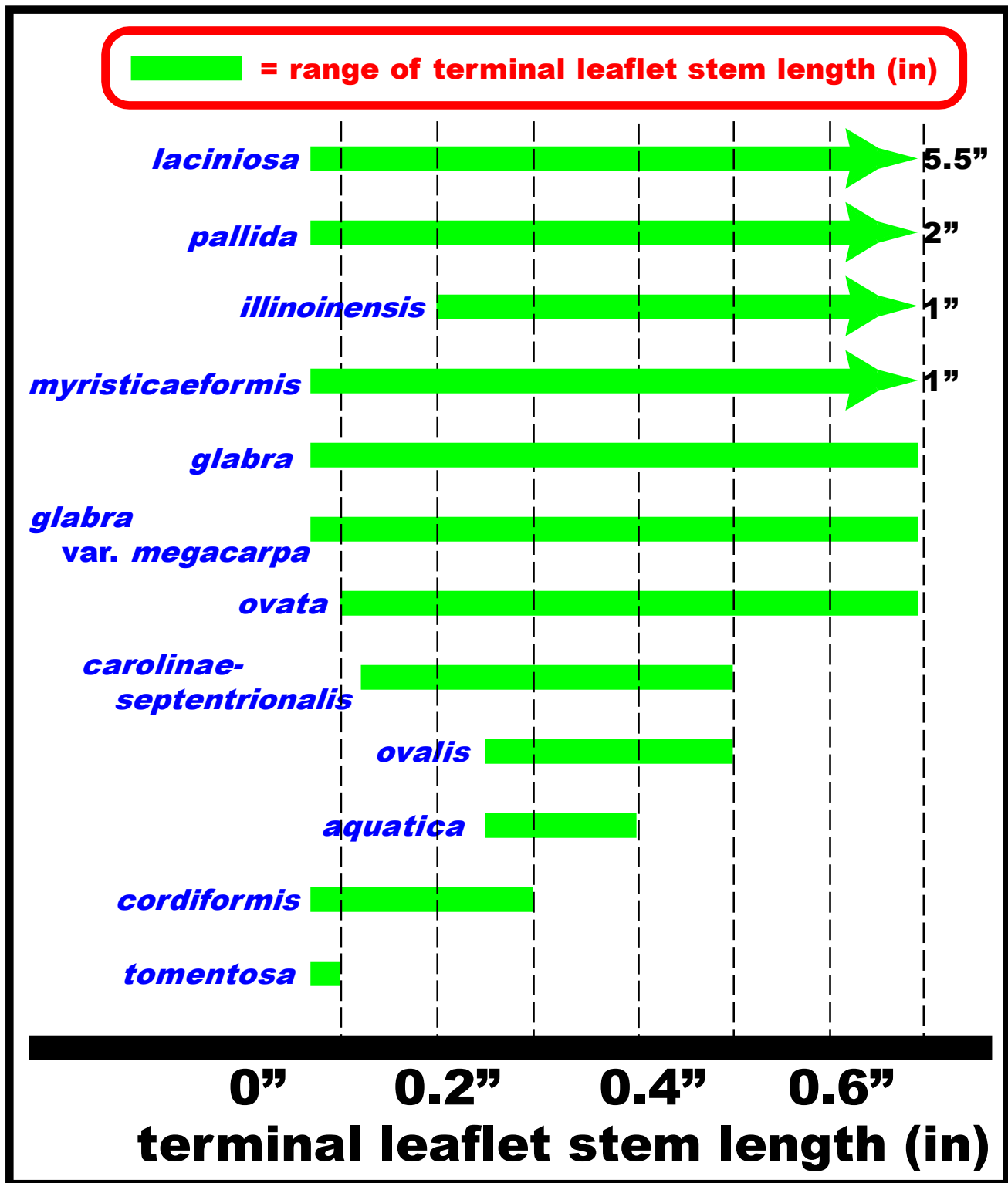


Figure 9: Terminal leaflet stem (petiolules) length range in inches for native / naturalized hickories.

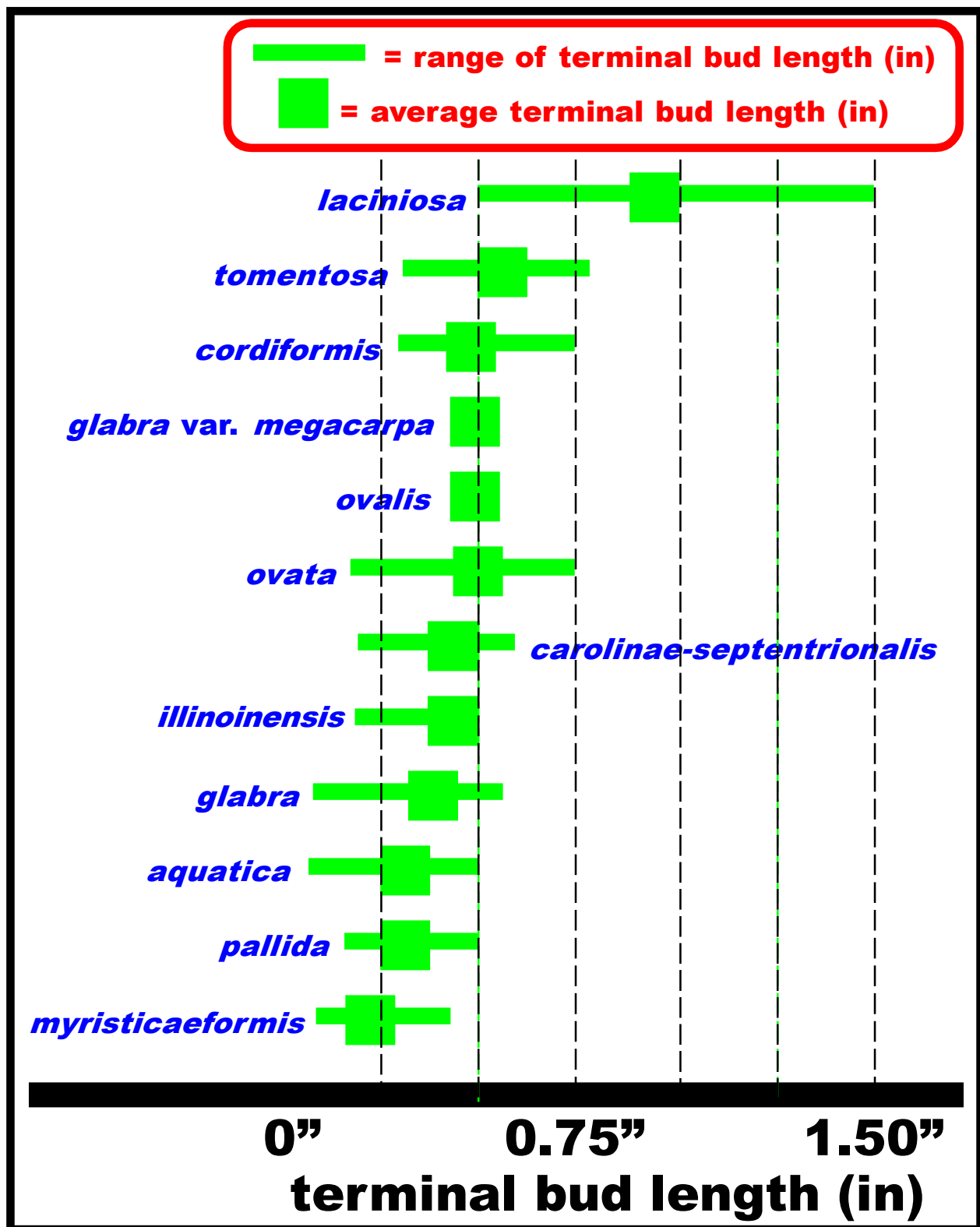


Figure 10: Terminal bud length average and range in inches for native / naturalized hickories, listed by scientific name.

HICKORY TWIG TIP

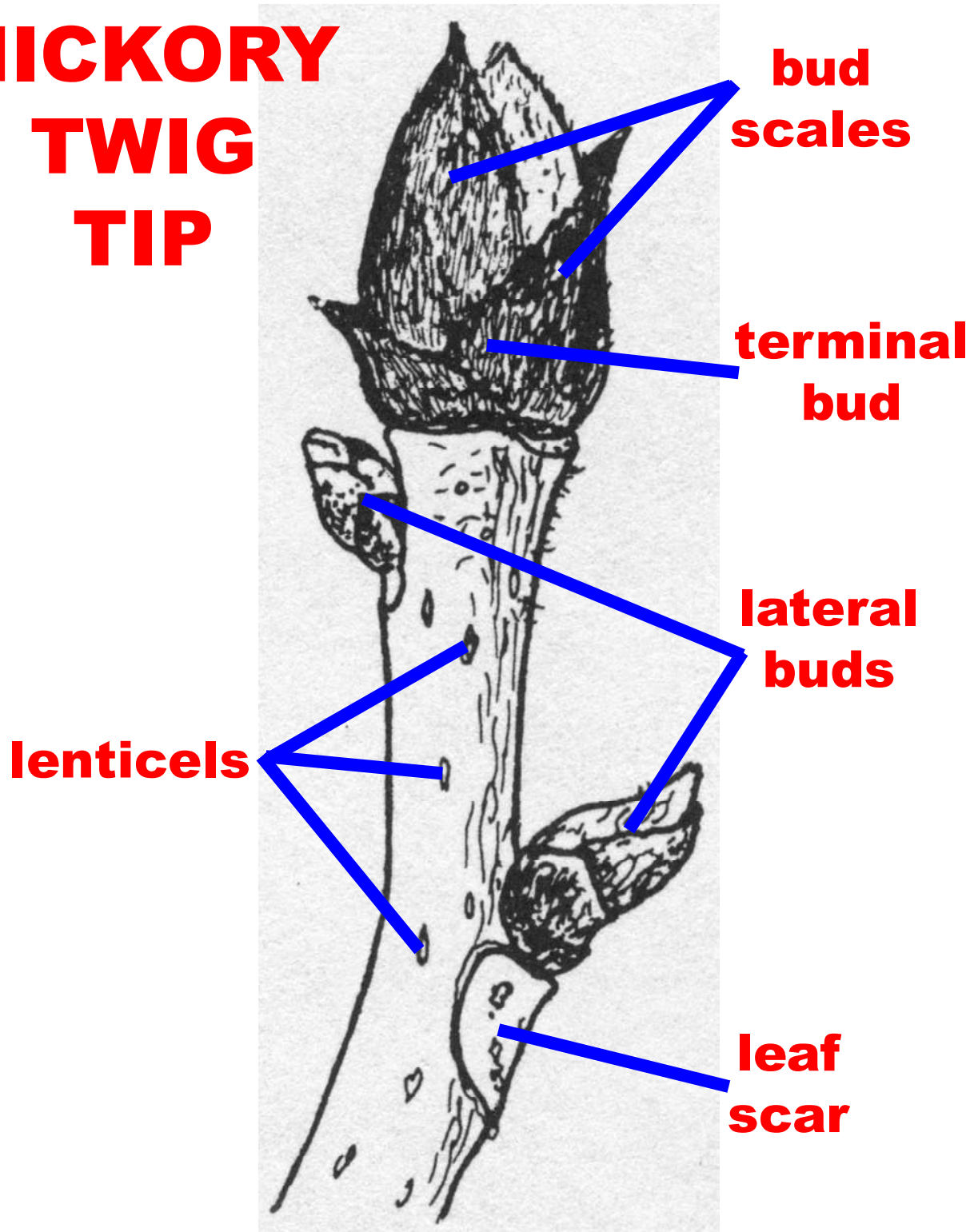


Figure 11: Example image of twig tip and terminal bud for *Carya ovata* (shagbark hickory). (image by R. Lance / UGA Press)

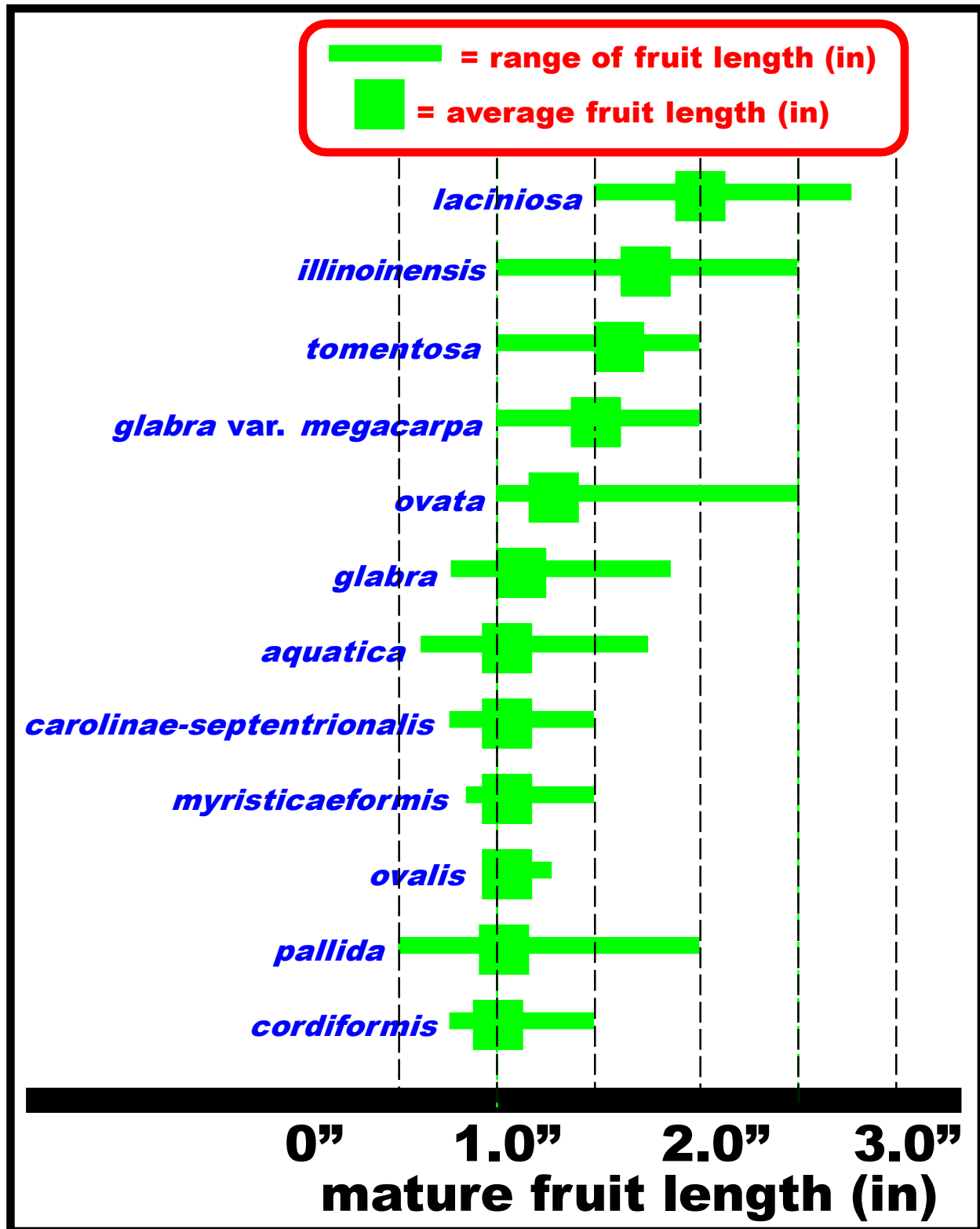


Figure 12: Mature fruit length average and range in inches for native / naturalized hickories, listed by scientific name.

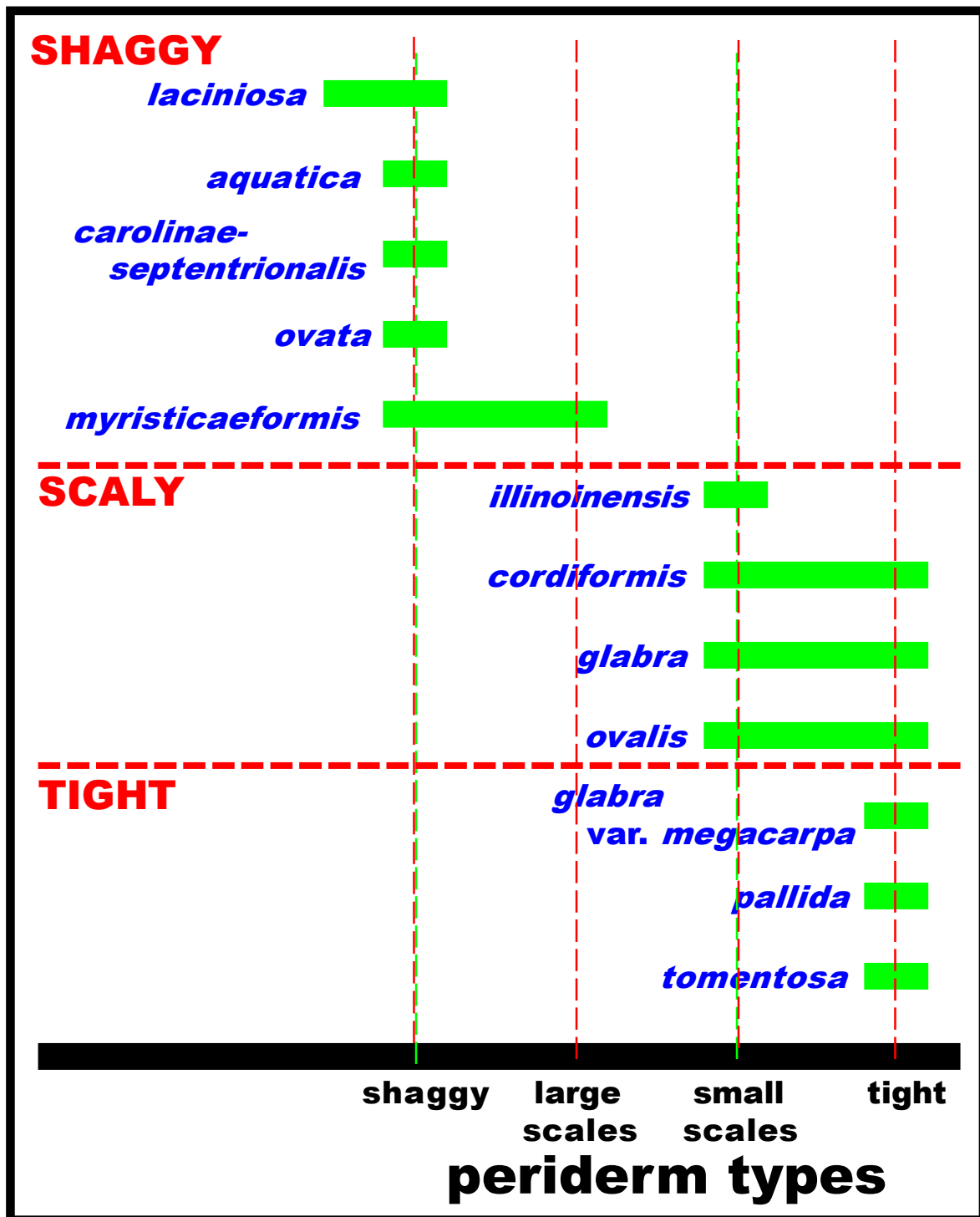
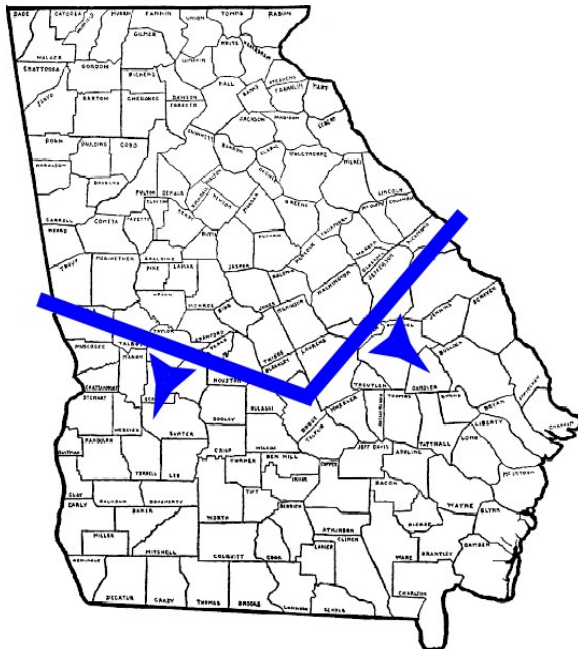
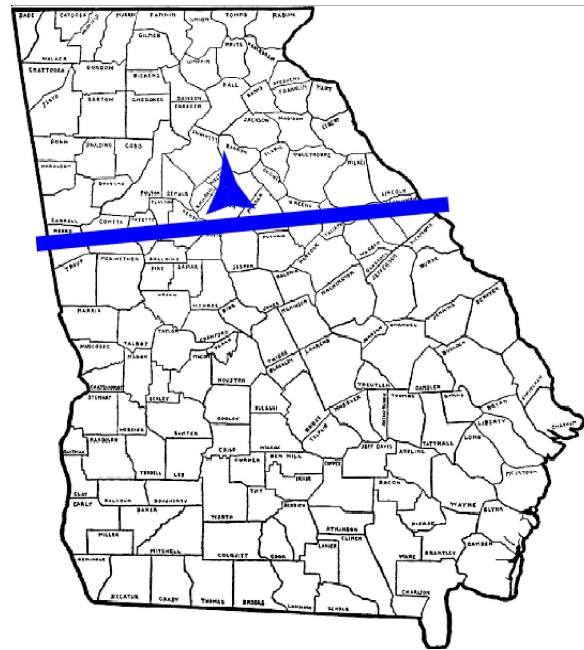


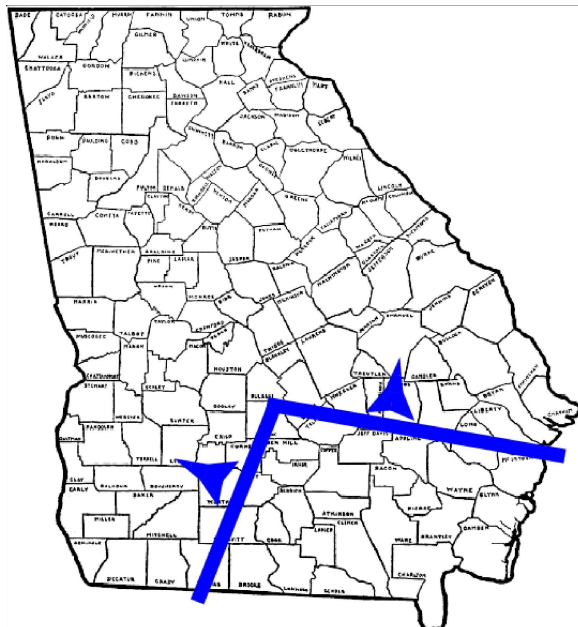
Figure 13: Periderm (bark) types or textures for native / naturalized hickories, listed by scientific species name.



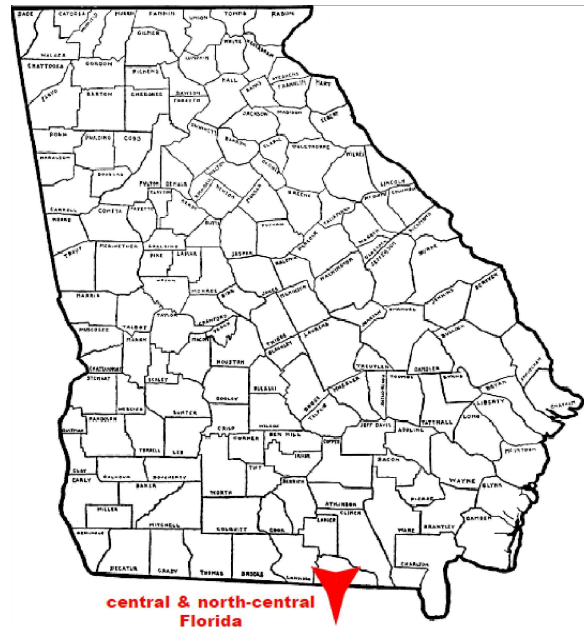
Carya aquatica



Carya carolinae-septentrionalis

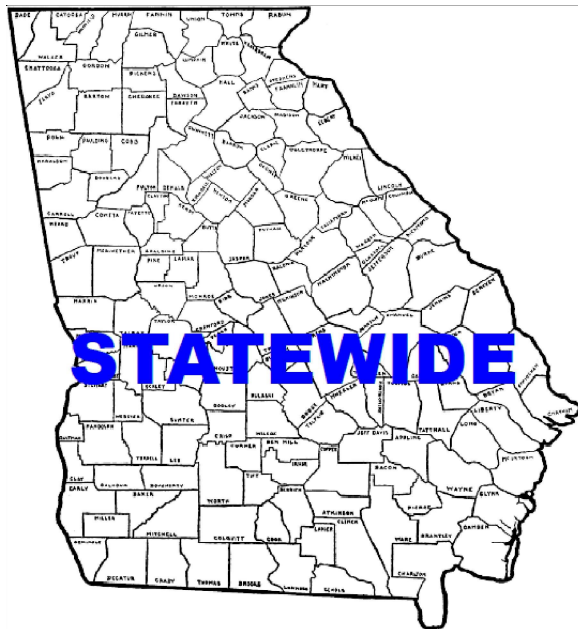


Carya cordiformis

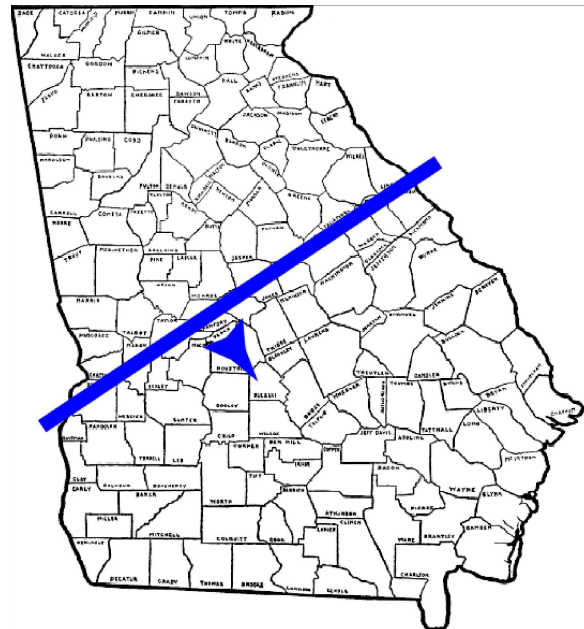


central & north-central
Florida
Carya florida

Figure 14: General range of hickory species in Georgia.



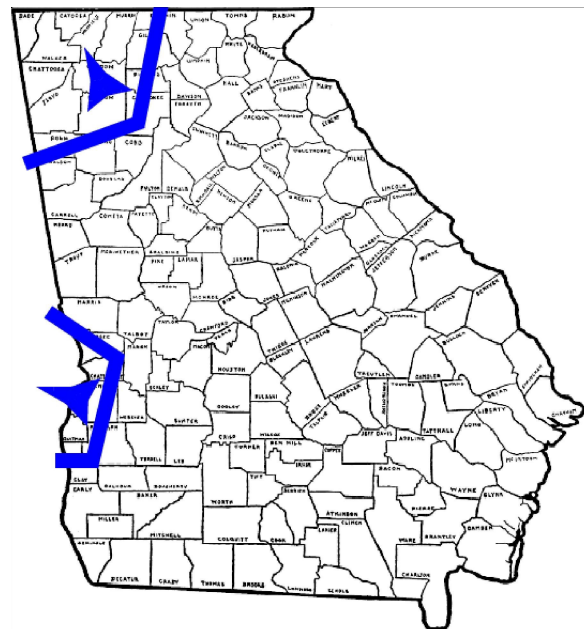
Carya glabra



Carya glabra var. *megacarpa*

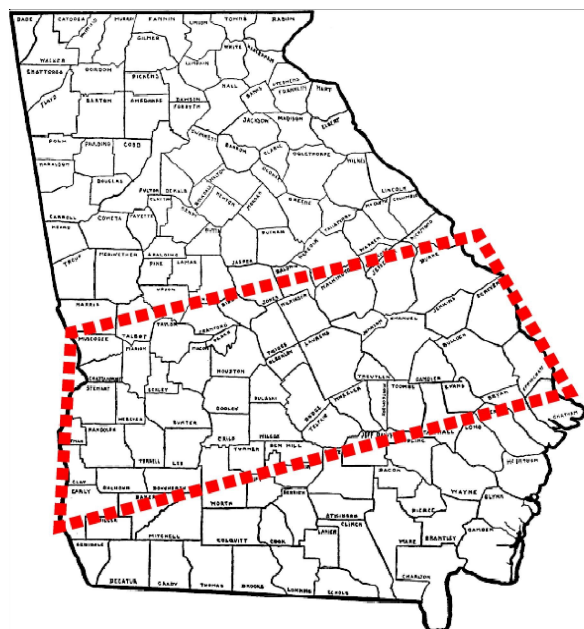


Carya illinoensis

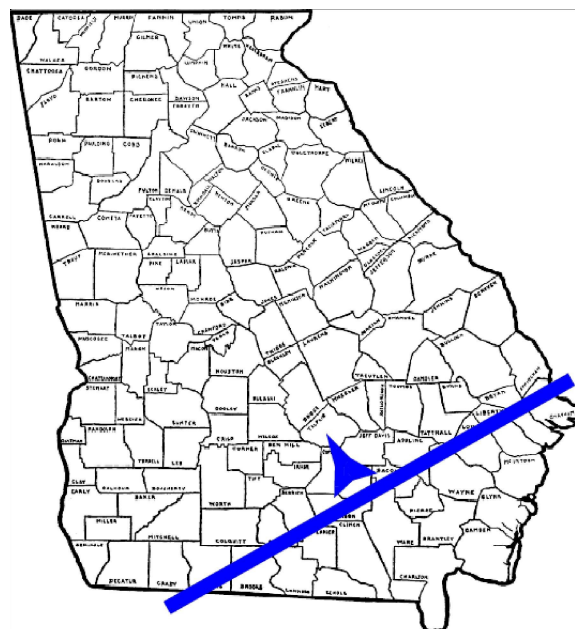


Carya laciniosa

Figure 14: General range of hickory species in Georgia.
(continued)



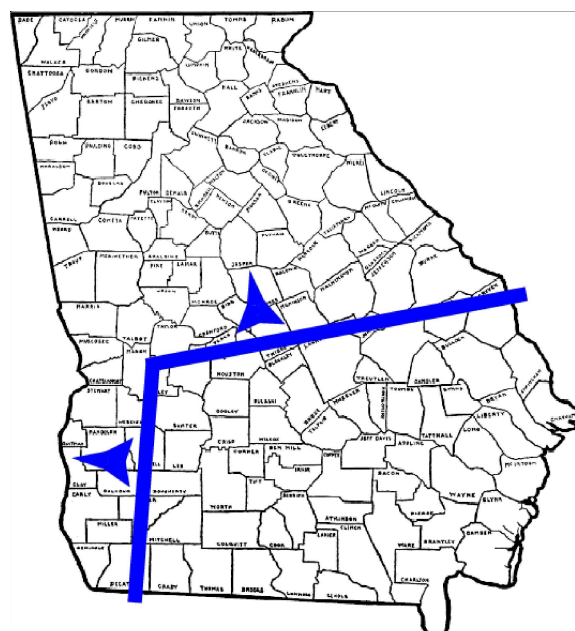
Carya myristiciformis



Carya ovalis

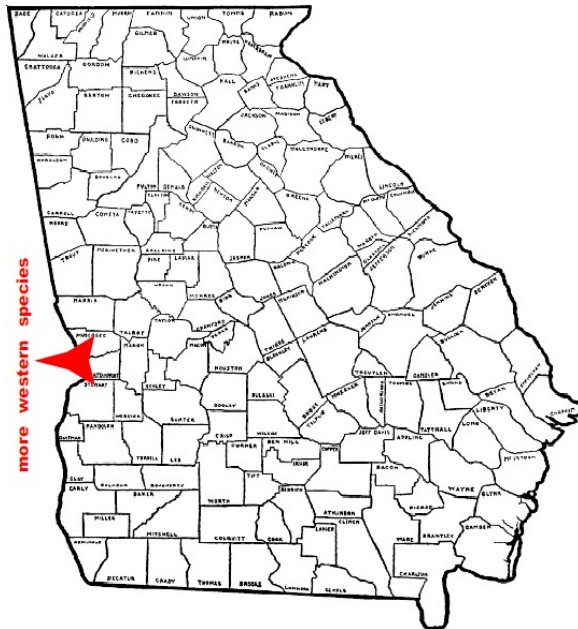


Carya ovata



Carya pallida

Figure 14: General range of hickory species in Georgia.
(continued)



Carya texana



Carya tomentosa

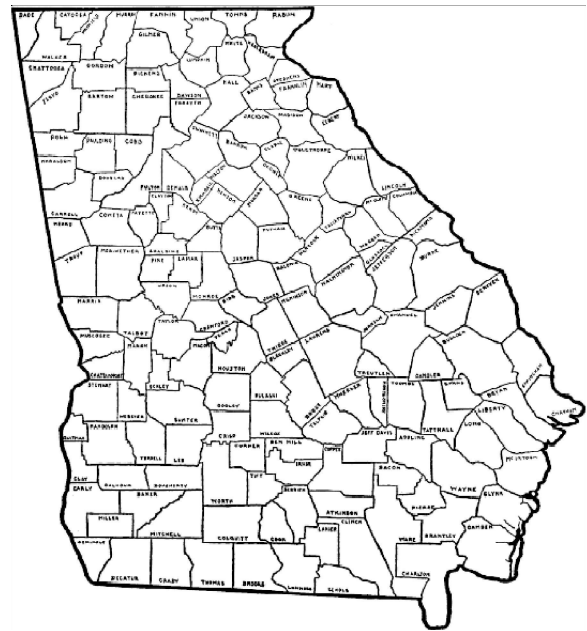
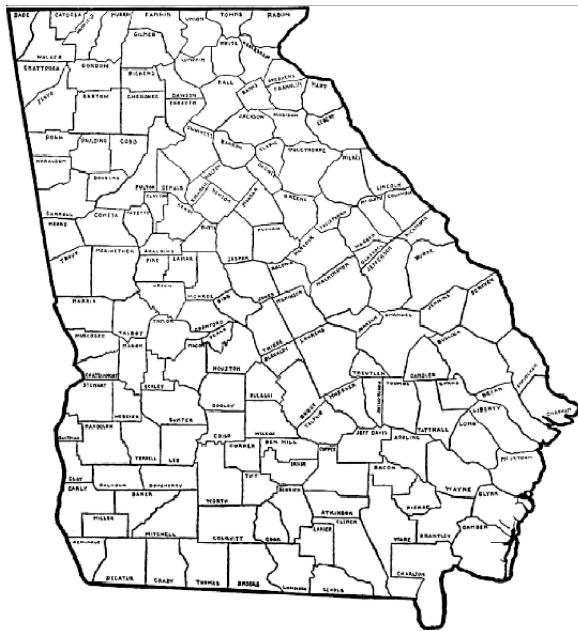


Figure 14: General range of hickory species in Georgia.
(continued)

