Carya ovata Juglandaceae family

Shagbark hickory, shellbark hickory, scalybark hickory, upland hickory

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Description: *Carya ovata* is a long-lived, slow growing, monoecious, medium to large, deciduous tree. Flowers open when the leaves are nearly fully expanded. Reproduction is by seed, and vegetatively. Maturity occurs at about 40 years of age. Fruiting occurs every 1-3 years, with little to no production in intervening years. Trees typically sprout prolifically following disturbance and/or damage; trees of diameters of 8-10 in. (20-24 cm) typically sprout from the stump or root crown, but trees of increased diameter will more typically sprout from their roots.

Variation: *Carya ovata* has two recognized varieties in some taxonomic systems, and three in others. *Carya ovata* hybridizes naturally with *Carya cordiformis* (butternut hickory), *Carya illinoensis* (pecan), and *Carya laciniosa* (shellbark hickory). Cultivars and hybrids have been developed within the horticultural trade.

Size: Grows to 60-90 ft. (18-27 m) tall, and up to 150 ft. (46 m) tall, and 25-40 ft. (7.6-12 m) wide; averages 12-24 in. (30-61 cm) in diameter, and up to 115 in. (292 cm).

Leaves: Leaves alternate. Leaf blade/lamina oddly once-pinnately compound, 8-24 in. (20-60 cm) long; typically 5, sometimes 3 or 7, leaflets; terminal leaflet much larger than laterals; leaf petiole 1.5-5 in. (4-13 cm) long; petiole and rachis hirsute to glabrous. Leaflets lanceolate, oblong to oblanceolate; 4-8 in. (10-20 cm) long, 2-3 in. (5-7.6 cm) wide; pinnately veined; margins finely to coarsely serrate, ciliate and/or with tufts of hairs; apex acute to acuminate; upper surface dark yellow-green to green, lower surface paler, often hirsute; lateral leaflets sessile to subsessile, terminal leaflet petiolule 0.1-0.7 in. (0.3-1.7 cm) long.

Inflorescence:
Staminate (male) inflorescence: Staminate flowers occur in long-stalked (pedunculate) pendulous catkins/aments, in groups of 3; 2-6 in. (5-15 cm) long, glandular hirsute; peduncles and bracts glabrous; bracts 2-3 times longer than calyx lobes. Inflorescence from the inner scales of the terminal buds on old wood (base of current growth) or in the axils of the previous season's leaves.
Pistillate (female) inflorescence: Pistillate flowers occur in short terminal spikes, 2-5 flowered. *Need info.

Flowers: Monoecious (separate male and female flowers occurring on same plant). Staminate (male) flowers: Flowers yellow-green. Stamens 4, hirsute above middle. Pistillate (female) flowers: Flowers 0.3 in (0.8 cm) long; tomentose. *Need info.

Fruit: A nut. Fruit smooth, globose to subglobose to obovoid, depressed at the apex; 1-2.5 in. (2.5-6.4 cm) in diameter; borne singly or in clusters of 2-3. Nut enclosed in a husk; husk 0.2-0.6 in. (0.4-1.5 cm) thick; green turning to brown to brownish black as they ripen. Husk, at maturity, dries and splits freely to the base into four valves along grooved sutures. Enclosed nut is light brownish white to tan, ovoid, obovoid to oblong-ovate, somewhat compressed, usually prominently four-angled at apex and rounded at the base; shell is relatively thin to sometimes thick; seed light brown.

Bark: Bark is light gray to gray-brown; smooth when immature, turning fissured or shaggy when mature, separating into large strips and plates curving away from trunk. Twigs are stout and hirsute or glabrous, with numerous lighter lenticels, greenish, reddish, or orangish brown.

Roots: This plant develops a large and deep taproot with a few lateral roots.

Habitat: *Carya ovata* is commonly associated with upland slopes in its northern distribution, and with river bottoms and coves in the south, but is also found on lower slopes in ravines, valleys, swamp edges, and wooded bluffs. It rarely forms pure stands. It grows best in humid climates. It occurs on soils of sedimentary and metamorphic parent materials, and across a wide range of soil fertility conditions. It appears tolerant of lead and zinc. It has intermediate shade tolerance.

Species distribution in US states: AL, AR, CT, DC, DE, GA, IA, IL, IN, KS, KY, LA, MA, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV

Species images:

Whole plant:
http://www.hort.uconn.edu/Plants/c/carova/carova1.html
http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=CAROVA2vOVA

Bark:
http://www.uwgb.edu/BIODIVERSITY/herbarium/trees/carova_bark01.jpg
http://www.hort.uconn.edu/Plants/c/carova/carova1.html
http://www.cas.vanderbilt.edu/bioimages/species/frame/caov2.htm

Leaf:
http://www.forestryimages.org/images/768x512/0008353.jpg

http://www.ag.auburn.edu/hort/landscape/dbpages/17.html
leaf margins: http://www.duke.edu/~cwcook/trees/caov.html
http://www.cas.vanderbilt.edu/bioimages/biohires/c/hcaov2-lfmarginal-hair16192.JPG

Leaf underside:
http://www.cas.vanderbilt.edu/bioimages/biohires/c/hcaov2-lfmargin-uplow-q15898.JPG

Colored leaves:
http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=CAROVA2vOVA
http://www.cnr.vt.edu/DENDRO/DENDROLOGY/fall/covata.jpg
http://www.floridata.com/ref/C/cary_ova.cfm

Buds:
http://www.uwgb.edu/BIODIVERSITY/herbarium/trees/carova_bud03_web300gf.jpg
http://www.forestryimages.org/images/768x512/0008503.jpg
http://www.forestryimages.org/images/768x512/0008504.jpg

Budburst:
just before budburst:
http://www.duke.edu/~cwcook/trees/caov.html
just following budburst:
http://www.duke.edu/~cwcook/trees/caov.html
http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=CAROVA2vOVA

Leaf expansion:
http://www.forestryimages.org/images/768x512/0008354.jpg

Staminate (male) inflorescence:
developing:
http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=CAROVA2vOVA
flowering:
http://www.forestryimages.org/images/768x512/0008086.jpg

Pistillate (female) inflorescence:
http://www.forestryimages.org/images/768x512/0008085.jpg

Staminate (male) flowers: *Need photo.

Pistillate (female) flowers: *Need photo.

Fruit:
developing:
http://www.forestryimages.org/images/768x512/0008087.jpg
nearly mature:
http://www.forestryimages.org/images/768x512/0008211.jpg
http://www.uwgb.edu/BIODIVERSITY/herbarium/trees/carova_fruit01.jpg

mature, and nut with shell exposed:
http://www.cas.vanderbilt.edu/bioimages/biohires/c/hcaov2-fr30195.JPG
nut:
http://plants.usda.gov/java/largeImage?imageID=caov2_004_ahp.tif
http://botany.cs.tamu.edu/FLORA/dcs420/c/hdw210898cs.jpg

Expected timing of growth stages:

Flowering: March-late June, depending on location. Late March in its southwestern distribution, and early June in the North and Northeast U.S.

Bud swell: *Need info.

Bud break: *Need info.

Leaf out: *Need info.

Leaf/canopy development: Nearly fully expanded at flowering; March-late June, depending on location.

Bud formation: *Need info.

Fruit development: *Need info.

Fruit ripening: September-October, depending on location. It splits into four pieces.

Seed dispersal: September-December.

Leaf coloration: *Need info.

Leaf fall: *Need info.

Phenophases to be monitored for NPN:

Leaf out

- *First leaf*
  In at least 3 locations on the plant, the very first green tip of a young leaf has visibly moved out of the leaf bud.

Flowering

- *First pollen released* **[Intensive only]**

In at least 3 locations on the plant, pollen is released from a flower when gently shaken or blown. For *Carya ovata*, the male flowers from which pollen is released are arranged on catkins. Where catkins are out of reach, pollen release may be estimated by observing the degree of catkin elongation and looseness. Once the initially compact catkins have unfolded and are hanging loosely, pollen will be released.

Leaf elongation

Note: These measures can be difficult to estimate without a few seasons of practice.

- *25% leaf elongation* **[Intensive only]**
  The majority of young leaves have unfolded completely and have expanded to one-quarter (25%) of their mature size. Leaf elongation may also be estimated by viewing the canopy as a whole. At 25% leaf elongation, the canopy appears to be approximately one-quarter (25%) full.

- *50% leaf elongation* **[Intensive only]**
  The majority of young leaves have unfolded completely and have expanded to half (50%) of their mature size. Leaf elongation may also be estimated by viewing the canopy as a whole. At 50% leaf elongation, the canopy appears to be approximately half (50%) full.

- *75% leaf elongation*
  The majority of young leaves have unfolded completely and have expanded to three-quarters (75%) of their mature size. Leaf elongation may also be estimated by viewing the canopy as a whole. At 75% leaf elongation, the canopy appears to be approximately three-quarters (75%) full.

- *Full leaf elongation* **[Intensive only]**
  The majority of young leaves have unfolded completely and have expanded to 95-100% of their mature size. At full leaf elongation, the canopy appears to have reached its full density.

Fruit ripening

- *First fruit ripe*
  In at least 3 locations on the plant, a fruit has become ripe. In *Carya ovata*, a fruit is considered ripe when the husk turns dark brown and splits open to release the nut inside. Ripeness may also be indicated by the presence of at least 3 fresh hickory nuts on the ground below the plant (that are not apparently from a nearby tree).

- *50% of fruit ripe* **[Intensive only]**
  For the whole plant, half (50%) of the fruits are ripe. In *Carya ovata*, this occurs when half (50%) of the fruits have split to release the nut.

- *All fruit ripe* **[Intensive only]**
  For the whole plant, virtually all (95-100%) of the fruits are ripe. In *Carya ovata*, this occurs when all (95-100%) of the fruits have split to release the nut.

Leaf color change

Note: If drought seems to be the cause of leaf color change for a plant, please make a comment about it for that plant.

- *First leaf colored* **[Intensive only]**
  In at least 3 locations on the plant, the green leaves have begun to change to their late season colors.

- *25% of leaves colored* **[Intensive only]**
  For the whole plant, one-quarter (25%) of the leaves (including any that have fallen to the ground) have changed to their late season colors.

- *50% of leaves colored*
  For the whole plant, half (50%) of the leaves (including any that have fallen to the ground) have changed to their late season colors.

- *75% of leaves colored* **[Intensive only]**
  For the whole plant, three-quarters (75%) of the leaves (including any that have fallen to the ground) have changed to their late season colors.

- *All leaves colored*
  For the whole plant, virtually all (95-100%) of the leaves (including any that have fallen to the ground) have changed to their late season colors and there is virtually no green left in the leaves.

Leaf fall

Note: If drought seems to be the cause of leaf fall for a plant, please make a comment about it for that plant.

- *First leaf fallen* **[Intensive only]**
  In at least 3 locations on the plant, a leaf easily falls off into your hand when touched or gently handled. First leaf fallen may also be indicated by the presence of at least 3 leaves on the ground below the plant (that are not apparently from another individual nearby).

- *25% of leaves fallen* **[Intensive only]**
  For the whole plant, one-quarter (25%) of the leaves have fallen.

- *50% of leaves fallen*
  For the whole plant, half (50%) of the leaves have fallen.

- *75% of leaves fallen* **[Intensive only]**
  For the whole plant, three-quarters (75%) of the leaves have fallen.

- *All leaves fallen*
  For the whole plant, virtually all (95-100%) of the leaves have fallen.

Did you know? *Carya ovata* was formerly used to make wheels and spokes for wagons, carriages, carts, and early automobiles. It is currently used to make furniture, flooring, tool handles, dowels, ladders, sporting goods, charcoal, and is an excellent fuelwood. Its nuts were a stable food of some Native American people, and are eaten by a wide variety of birds and animals.

Bibliography:

Cofrin Center for Biodiversity, Herbarium, University of Wisconsin, Green Bay; accessed 6/30/08: http://www.uwgb.edu/BIODIVERSITY/herbarium/trees/carova01.htm

Flora of North America; accessed 6/30/08: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500320

North Carolina State University, NC Cooperative Extension; accessed 6/30/08: http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/trees-new/carya_ovata.html

Sargent, C.S. 1965. Manual of the trees of North America, Vol. I. Dover Publications, Inc. 452 pp.

680 Tree Fact Sheets, University of Florida; accessed 6/30/08: http://hort.ufl.edu/trees/CAROVAA.pdf

Tirmenstein, D. A. 1991. Carya ovata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ ; accessed 6/30/08: http://www.fs.fed.us/database/feis/plants/tree/carova/all.html

UConn Plant Database of trees, shrubs, and vines; accessed 6/30/08: http://www.hort.uconn.edu/Plants/c/carova/carova1.html

USDA Forest Service, Silvics of North America, Vol. 2, Hardwoods; accessed 6/30/08: http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/carya/ovata.htm

USDA Plants Database; accessed 6/30/08: http://plants.usda.gov/

Virginia Tech, Department of Forestry, College of Natural Resources; accessed 6/30/08: http://www.cnr.vt.edu/DENDRO/dendrology/syllabus/factsheet.cfm?ID=20

Notes
The USDA PLANTS symbol for this plant is CAVO2.
The ITIS Taxonomic Serial No. for this species is 19243.

BBCH codes for phenophases used for this plant are available from the USA-NPN office upon request.

Proposed modifications, updates or corrections to this protocol are welcome; please direct correspondence to the USA-NPN National Coordinating Office.

Prior versions of this species protocol will be made available in a documents library on USA-NPN webpage.

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