

## ***Quercus rubra***

## **Fagaceae family**

Northern red oak, red oak, common red oak, eastern red oak, mountain red oak, gray oak

[Description](#)

[Distribution in US](#)

[Images](#)

[Timing of growth](#)

[Phenophases to be monitored for NPN](#)

[Did you know](#)

[Bibliography](#)

[Notes](#)

**Description:** *Quercus rubra* is a medium to large, moderate to fast-growing, long-lived, monoecious, deciduous tree. Flowering occurs before and/or during leaf development. Wind-pollinated. Reproduction begins when the tree is between 20-25 years old, although production isn't abundant until about 50 years old; occasionally on good sites, reproduction begins earlier. Vigorous stump and root sprouting occur with damage and disturbance; sprouting of latent branch/stem buds (epicormic) can also occur. Fruiting biennial.

Variation: There are several recognized varieties of *Quercus rubra*. Some taxonomists do not recognize these varieties and combine all variation under one species. *Quercus rubra* hybridizes with many other *Quercus* species with many named. Several cultivars have been developed in the horticultural trade.

**Size:** *Quercus rubra* grows to 50-165 ft. (15-50 m) tall, 40-60 ft. (12-18.3 m) wide; and its trunk 2-3 ft. (0.6-0.9 m) in diameter (rarely to 8 ft. (2.4 m)).

**Leaves:** Leaves alternate. Leaf blades/lamina simple; ovate to elliptic or obovate; 3-12 in. (7.5–30.5 cm) long; 2-8 in. (5–20 cm) wide; 7–11 shallow wavy lobes, pinnately lobed; lobe apices acute and aristate/awned (sharp-pointed); sinuses usually 1/4-1/2 distance to midvein; margins have irregular bristle-tipped teeth; upper surface glabrous or glabrate or tomentose, dull green; lower surface light dull green to yellow green, glabrous occasionally semi-glaucous to tomentose, tufts of hairs in vein axils. Petiole 0.6-2.4 in. (1.5-6 cm) long, glabrous, often red-tinged. Stipules present, free from petiole, caducous.

**Inflorescences:** Male and female flowers in separate inflorescences (monoecious).

Staminate (male) catkins axillary in previous year's growth; pendant; rachis moderately covered with brown to white hairs, glabrescent with age; 1 subsessile or sessile flower per node; each flower subtended by a small, sessile, caducous bracteole. Catkins solitary or fascicled.

Pistillate (female) spikes axillary in current year's growth; 1-many flowers.

Flowers:

Staminate (male) flowers: Perianth of 1 whorl, calyx of fused sepals; 0.2 in. (0.4-0.5 cm) in diameter; campanulate; 2-8 lobes, having brown to white hairs moderately dense along margins; no petals; stamens 4-5, exserted.

Pistillate (female) flowers: Perianth of 1 whorl, minute; calyx of fused sepals, 2-8 lobes, urceolate; no petals; pistil 1; carpels 3; styles 3, each with 1 stigma.

Fruit: An acorn; ovoid-oblong; 0.6-1.3 in. (1.5-3.3 cm) long; sessile to short pedunculate. Matures in two years. Cupule (acorn cap) shallow, saucer-shaped; covering 1/4-1/3 of fruit; puberulent; scales imbricate, appressed; scales often with dark margins; initially having minute short, appressed brown to light brown hairs. Nut ovoid to oblong, glabrous; 1, rarely 2-3, seeded. Occur single or in clusters of 2-5.

Bark: Dark gray or black; ridges wide, shiny, hard scaly, shallowly furrowed; inner bark reddish to pinkish. Branches and upper trunk marked with long, light gray longitudinal lines. Twigs reddish-brown, pubescent or glabrous.

Roots: The root system generally develops a strong taproot with a network of deep, spreading laterals. Due to the plant's habit of above-ground seedling die-back during years of drought and cold stress or disturbance/damage and then resprouting from the root collar, the root system can be 15 years older than the above-ground plant.

Habitat: This plant grows on a variety of dry-mesic to mesic sites. It is common on well-drained uplands and mesic slopes, lower and middle slopes, north and east facing slopes, and can occur in rich, mesic woods, sandy plains, rock outcrops, stable interdunes, and outer edges of floodplains. It favors full sun and well-drained, slightly acidic, sandy loam soils. Its seedlings are more successful in establishing when on sunny sites, but the plants can tolerate some shade as it ages.

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

### Species images:

Whole plant:

<http://www.hort.uconn.edu/Plants/q/querub/querub1.html>

<http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=QUERUB>

Bark:

<http://www.duke.edu/~cwcook/trees/quru.html>

<http://www.hort.uconn.edu/Plants/q/querub/querub1.html>

<http://www.cas.vanderbilt.edu/bioimages/biohires/q/hquru--br15732.JPG>

Leaf:

<http://www.forestryimages.org/images/768x512/0008396.jpg>  
<http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=QUERUB>  
budbreak: <http://www.forestryimages.org/images/768x512/1125094.jpg>

Colored leaves:

<http://www.hort.uconn.edu/Plants/q/querub/querub1.html>  
<http://www.forestryimages.org/images/768x512/5143014.jpg>  
<http://www.forestryimages.org/images/768x512/1480413.jpg>

Buds:

<http://www.cnr.vt.edu/DENDRO/dendrology/syllabus/factsheet.cfm?ID=38>  
<http://www.forestryimages.org/images/768x512/1219197.jpg>  
<http://www.forestryimages.org/images/768x512/0008541.jpg>  
broken dormancy: <http://www.forestryimages.org/images/768x512/1125095.jpg>

Staminate (male) flowers:

[http://calphotos.berkeley.edu/cgi/img\\_query?query\\_src=photos\\_index&enlarge=0000+0000+0105+0847](http://calphotos.berkeley.edu/cgi/img_query?query_src=photos_index&enlarge=0000+0000+0105+0847)  
[http://calphotos.berkeley.edu/cgi/img\\_query?query\\_src=photos\\_index&enlarge=0000+0000+0107+1542](http://calphotos.berkeley.edu/cgi/img_query?query_src=photos_index&enlarge=0000+0000+0107+1542)  
<http://www.cas.vanderbilt.edu/bioimages/biohires/q/hquru--flinflor18084.JPG>

Pistillate (female) flowers:

<http://www.cas.vanderbilt.edu/bioimages/biohires/q/hquru--flfemale18096.JPG> (mixed with staminate flowers)  
<http://www.forestryimages.org/images/768x512/0008117.jpg>

Fruit:

[http://plants.usda.gov/java/largeImage?imageID=quru\\_005\\_ahp.tif](http://plants.usda.gov/java/largeImage?imageID=quru_005_ahp.tif)  
<http://www.uwgb.edu/BIODIVERSITY/herbarium/trees/querub01.htm>  
<http://www.forestryimages.org/images/768x512/0008245.jpg>

### **Expected timing of growth stages:**

Gemination: Generally spring.

Flowering: April-May, depending on location.

Bud break/Leaf out: \*Need info. Budbreak tends to be delayed on sites with copper, lead, or zinc mineralized soil.

Leaf/canopy development: May-June.

Fruit ripening: Requires 2 seasons for development/maturity; August-late October.

Leaf coloration: \*Need info.

Leaf fall: \*Need info.

## **Phenophases to be monitored for NPN:**

### **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 *Quercus rubra*, 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. (Note that *Quercus rubra* individuals may not produce catkins every year.)

### **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. For *Quercus rubra*, the young leaf may appear pinkish.

### **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 *Quercus rubra*, a good test for ripeness is acorn drop; ripe acorns will easily fall into your hand when touched or gently handled. Ripeness may also be indicated by the presence of at least 3 fresh acorns on the ground below the plant (that are not apparently from a nearby tree). (Note that *Quercus rubra* acorns take two years to mature.)
- *50% of fruit ripe* [**Intensive only**]  
For the whole plant, half (50%) of the fruits are ripe. In *Quercus rubra*, this occurs when half (50%) of the acorns have dropped.
- *All fruit ripe* [**Intensive only**]  
For the whole plant, virtually all (95-100%) of the fruits are ripe. In *Quercus rubra*, this occurs when all (95-100%) of the acorns have dropped.

### **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. For *Quercus rubra*, this includes any leaves that have dried and remain dead on the plant.
- *All leaves fallen*  
For the whole plant, virtually all (95-100%) of the leaves have fallen. For *Quercus rubra*, this includes any leaves that have dried and remain dead on the plant.

**Did you know?** *Quercus rubra* is an important source of hardwood lumber; also it is an important ornamental. It is used for furnishings, furniture, and railroad ties. Native Americans used the plant medicinally for many symptoms and its acorns for food. Many birds and animals feed on this plant and its acorns are an important food source.

## Bibliography:

Brooklyn Botanic Garden, New York Metropolitan Flora Project; accessed 3/4/08  
[http://nymf.bbg.org/profile\\_species\\_tech.asp?id=483](http://nymf.bbg.org/profile_species_tech.asp?id=483)

USA-NPN Plant Phenology Protocol, *Quercus\_rubra\_v1.1(beta).doc*

Flora of North America; accessed 3/4/08

[http://www.efloras.org/florataxon.aspx?flora\\_id=1&taxon\\_id=233501079](http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233501079)

Floridata; accessed 3/5/08

[http://www.floridata.com/ref/Q/quer\\_rub.cfm](http://www.floridata.com/ref/Q/quer_rub.cfm)

Nesom, G. 2002. Northern red oak, *Quercus rubra*. USDA NRCS National Plant Data Center. Baton Rouge, LA. [http://plants.usda.gov/plantguide/doc/cs\\_quru.doc](http://plants.usda.gov/plantguide/doc/cs_quru.doc) ; accessed 3/4/08.

OpenKey, Illinois - North Carolina Collaborative Environment for Botanical Resources; accessed 3/5/08

<http://www.ibiblio.org/openkey/intkey/web/QURU.htm>

680 Tree Fact Sheets, University of Florida; accessed 3/5/08

<http://hort.ufl.edu/trees/QUERUBA.pdf>

Tirmenstein, D. A. 1991. *Quercus rubra*. 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 3/4/08: <http://www.fs.fed.us/database/feis/plants/tree/querub/all.html>

Trees, Shrubs, and Woody Vines of North Carolina, Will Cook's Web Site; accessed 3/5/08

<http://www.duke.edu/~cwcook/trees/quru.html>

UConn Plant Database of trees, shrubs, and vines; accessed 3/5/08

<http://www.hort.uconn.edu/Plants/q/querub/querub1.html>

USDA Forest Service, Silvics of North America, Vol. 2, Hardwoods; accessed 3/4/08

[http://www.na.fs.fed.us/spfo/pubs/silvics\\_manual/volume\\_2/quercus/rubra.htm](http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/quercus/rubra.htm)

USDA Plants Database; accessed 3/4/08

<http://plants.usda.gov/>

images:

Bioimages, Vanderbilt University 3/5/08

<http://www.cas.vanderbilt.edu/bioimages/biohires/q/hquru--br15732.JPG>

<http://www.cas.vanderbilt.edu/bioimages/species/frame/qual.htm>

<http://www.cas.vanderbilt.edu/bioimages/biohires/q/hquru--flinfor18084.JPG>

<http://www.cas.vanderbilt.edu/bioimages/biohires/q/hquru--flfemale18096.JPG>

CalFlora, Photo Database; accessed 3/5/08

USA-NPN Plant Phenology Protocol, *Quercus rubra*\_v1.1(beta).doc

[http://calphotos.berkeley.edu/cgi/img\\_query?query\\_src=photos\\_index&enlarge=0000+0000+0107+1542](http://calphotos.berkeley.edu/cgi/img_query?query_src=photos_index&enlarge=0000+0000+0107+1542)

[http://calphotos.berkeley.edu/cgi/img\\_query?query\\_src=photos\\_index&enlarge=0000+0000+0105+0847](http://calphotos.berkeley.edu/cgi/img_query?query_src=photos_index&enlarge=0000+0000+0105+0847)

Cofrin Center for Biodiversity, Herbarium, University of Wisconsin, Green Bay;  
accessed 3/5/08

<http://www.uwgb.edu/BIODIVERSITY/herbarium/trees/querub01.htm>

Forestry Images: Forest Health, Natural Resources & Silviculture Images; accessed  
3/5/08

<http://www.forestryimages.org/images/768x512/0008117.jpg>

<http://www.forestryimages.org/images/768x512/0008396.jpg>

<http://www.forestryimages.org/images/768x512/5143014.jpg>

<http://www.forestryimages.org/images/768x512/0008245.jpg>

<http://www.forestryimages.org/images/768x512/1480413.jpg>

<http://www.forestryimages.org/images/768x512/1125094.jpg>

<http://www.forestryimages.org/images/768x512/1219197.jpg>

<http://www.forestryimages.org/images/768x512/1125095.jpg>

<http://www.forestryimages.org/images/768x512/0008541.jpg>

Robert W. Freckmann Herbarium, University of Wisconsin - Stevens Point; accessed

<http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=QUERUB>

UConn Plant Database of trees, shrubs, and vines; accessed 3/5/08

<http://www.hort.uconn.edu/Plants/q/querub/querub1.html>

USDA Plants Database; accessed 3/4/08

[http://plants.usda.gov/java/largeImage?imageID=quru\\_005\\_ahp.tif](http://plants.usda.gov/java/largeImage?imageID=quru_005_ahp.tif)

Virginia Tech, Department of Forestry, College of Natural Resources; accessed 3/5/08

<http://www.cnr.vt.edu/DENDRO/dendrology/syllabus/factsheet.cfm?ID=38>

## Notes

The USDA PLANTS symbol for this plant is QURU.

The ITIS Taxonomic Serial No. for this species is 19408.

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.

**Document history:** V1.1(beta) 08/20/08

**Protocol compiler:** Patty Guertin

**Reviewers:** Ellen Denny, John O'Keefe, Abe Miller-Rushing

USA National Phenology Network

National Coordinating Office

1955 East 6th Street

Tucson, AZ 85719

[www.usanpn.org](http://www.usanpn.org)