

# Hardwood Lumber and Veneer Series



## Red Oak

FNR-288-W

Daniel L. Cassens, Professor and Extension Wood Products Specialist  
Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907

**EXPERT**  
REVIEWED

“Red oak” is a term used in the lumber trade that refers to a category of lumber. This lumber category may contain as many as 17 different species of trees (See Table 1). It constitutes about one-third of all the hardwood lumber produced. Northern red oak is the most preferred species. It ranges throughout the eastern United States and Canada, except the southern coastal planes. It does well on moist but well-drained soils, and it is associated with numerous other species. The largest tree reported is nearly 11 feet in diameter at 4½ feet above the ground.

Black oak is the second most common species in the region. Its range is similar to that of northern red oak, but it does not extend as far north. Black oak grows best on the same site as northern red oak. Black oak is often found on poorer sites; and in these cases, the lumber quality is less than that of northern red oak. Black oak, shumond oak, southern red oak, and cherrybark oak are also important lumber species.

### Wood Color and Texture

Red oak wood color can vary from a very light pink, which is currently preferred, to a blood red color. Many manufacturers who process red oak lumber into parts will sort it for color, particularly if glued-up panels are being produced.

Red oak lumber has a very characteristic showy coarse grain pattern. It is a ring porous wood, which means that in the spring of the year it produces very large diameter pores that are visible to the naked eye. At some point during the growing season, it abruptly begins to produce very small diameter thick walled pores. The result is alternating layers of coarse and fine-textured wood.



Chip Morrison

Red oak tree

All of the oaks have very large wood rays. In fact, these rays are the largest of any North American lumber species. When oak is flat sawn, only the ends of the rays are exposed, and they are relatively inconspicuous in comparison to the large pores. When the lumber is quarter sawn, the boards are

cut on a radius from the pith or very center of the tree to the bark. The saw cuts parallel to the large wood rays; therefore, a very characteristic splotchy pattern results. Rift cut oak results when the rays are intersected at a 45° angle. In this situation, the ends of the rays appear somewhat larger than in flat sawn lumber; but more importantly, the wood appears pencil stripped as the alternating large earlywood pores run parallel to the small dense latewood pores. The industry usually prefers to sell quartered and rift cut oak together, with white oak being the preferred species to quarter saw. White oak will have the largest ray fleck.

Mineral stain or dark streaks and spots are common in red oak. If present, the ends of freshly cut logs will show dark lines, which follow the growth rings, or sometimes, small dark isolated spots. When excessive mineral stain is present, the National Hardwood Lumber grading rules require that the piece be lowered by one standard grade. However, most buyers who are interested in a light or natural finish will not accept pieces with any significant mineral stain.

### **Workability**

Red oak is rated as the best wood to plane and the second best in boring. It also receives very high scores for shaping and turning.

### **Strength**

At 12 percent moisture content, red oak lumber will weigh about 44 pounds per cubic foot, making it one of our heavier woods. It is also one of the strongest woods.

### **Steam Bending**

Red oak is rated near the very top as an excellent wood for bending.

### **Drying**

The wood is difficult to dry, and a mild schedule must be used. Freshly cut lumber can surface check within a day or less when exposed to the hot summer sun or when air drying proceeds too rapidly. Later in the drying process, internal checks, or honeycomb, can develop if the process proceeds too rapidly. Honeycomb usually occurs in the dry kiln, but it can occur on the air-drying yard as well. Commercial producers are aware of these drying problems and follow known procedures to avoid them.

### Shrinkage

As a heavy wood, red oak undergoes substantial shrinkage when drying. However, it is still somewhat less than the heavier woods such as white oak and hickory.

### Decay Resistance

Red oak is said to have slight to no resistance to decay. However, the heartwood in red oak logs will still be sound even after it lies in the woods for a few years. In these situations, the wood tends to darken

**Table 1. Scientific and common names, range, and preferred sites for red oak species growing in the eastern United States**

Common and Scientific Names	Range	Site	Comments
<b>Northern red oak</b> <i>Quercus rubra</i> L.	Eastern United States, except coastal plane, and Southern Canada	Uplands	Premier species
<b>Black oak</b> <i>Q. veluntina</i> Lam.	Nearly all of the eastern United States, and Southern Ontario	Uplands	Quality depends on site
<b>Shumard oak</b> <i>Q. shumardii</i> Buckl.	Southern portion of central states, South and Southeast	Bottomlands and Uplands	Good species
<b>Southern red oak</b> <i>Q. falcata</i> Michx.	Southeastern United States north to New Jersey and Ohio Valley,	Uplands	Quality depends on site
<b>Cherrybark oak</b> <i>Q. pagoda</i> Raf.	Coastal Plains and Central Mississippi river valley and south	Bottomlands	Premier species in south
<b>Scarlet oak</b> <i>Q. coccinea</i> Muenchh.	Appalachian region and north to New Hampshire	Uplands	Generally poor species
<b>Pin oak</b> <i>Q. palustris</i> Muenchh.	Western lake states and northern portion of midwestern states, central eastern United States and eastern states	Wet clay flats	Fast growth with many knots
<b>Northern pin oak and jack oak</b> <i>Q. ellipsoidalis</i> E.J. Hill	Southern Minnesota to central Mississippi and northern portion of midwestern states	Uplands sandy soil	Generally poor species
<b>Nuttall oak</b> <i>Q. texana</i> Buckley	Lower Mississippi river region	Bottomlands	Generally good species
<b>Willow oak</b> <i>Q. phellos</i> L.	Southeastern United States and coastal area north to New Jersey	Bottomlands	Quality depends on site
<b>Water oak</b> <i>Q. nigra</i> L.	Southeastern United States	Bottomlands	Quality depends on site
<b>Laurel oak</b> <i>Q. hemisphaerica</i> Bantr. ex Willd	Coastal planes	Well drained sandy soils	Quality depends on site
<b>Swamp laurel or diamond leaf</b> <i>Q. laurifolia</i> Michx.	Coastal planes	Bottomlands	Quality depends on site
<b>Shingle oak</b> <i>Q. imbricaria</i> Michx.	Appalachian mountains, Ohio, and central Mississippi river valley	Moist soils along streams and on hill sides	Generally poor species
<b>Bluejack oak</b> <i>Q. incana</i> Bantr.	Coastal planes	Scrub oak on sandhills	Not commercial
<b>Blackjack oak</b> <i>Q. marilandica</i> Muenchh.	New York to central Iowa and south	Scrub oak on dry, sterile soils	Not commercial
<b>Turkey oak</b> <i>Q. laevis</i> Walt.	Coastal plains	Scrub oak on dry sandy soils	Not commercial

making it unsuitable for some application. All red oak wood is very porous and will accept preservative treatment easily, making it a preferred species for railroad ties.

**Commercial Use, Grading, and Value**

Red oak is a “standard” for the industry. First, it is our most abundant species. It has a beautiful grain pattern and color characteristics. As such, it is preferred for interior decorative applications ranging from furniture, cabinets, millwork, and caskets to hardwood flooring. It is also a very dense strong wood making it a favorite for industrial applications, such as railroad ties, mine timbers, pallets, blocking, industrial and truck flooring, and others.

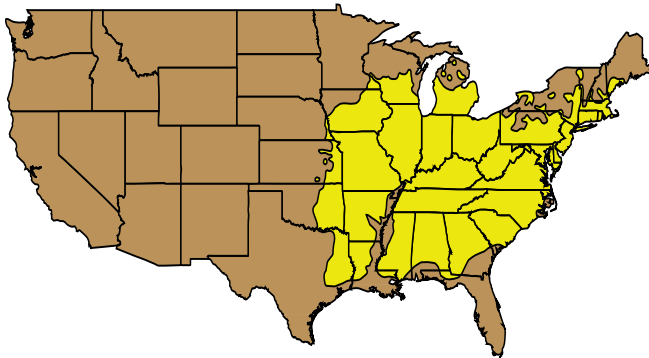
Red oak lumber when sold as flat sawn stock is graded standard with the exception that some mineral stain is allowed, but when excessive, it

will reduce a board one grade only. When quarter sawn, the minimum board width is reduced from 6 to 5 inches wide.

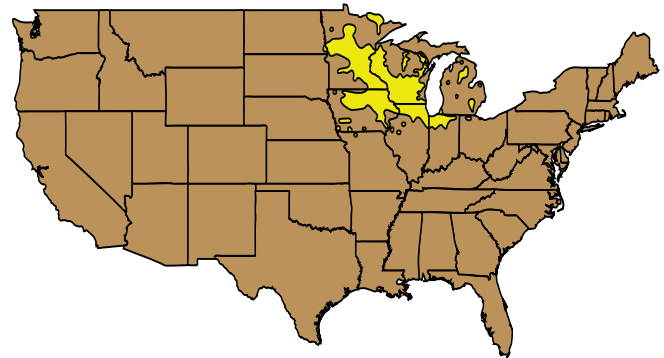
Red oak lumber is an intermediate priced material, less than woods like cherry, walnut, and hard maple, but usually more than white oak and ash.

**Other Considerations**

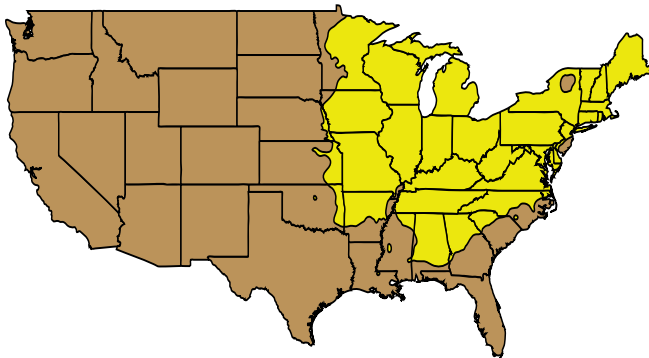
Red oak lumber can contain any number of different species and commercial production ranges throughout the eastern United States and southern Canada. As such, the lumber can vary in quality. Quality attributes include color, presence or absence of mineral, amount of sapwood, and growth rate. Wholesale prices also vary by region. Commercial buyers with demanding applications search for specific producers that can provide the quality levels needed at a competitive price.



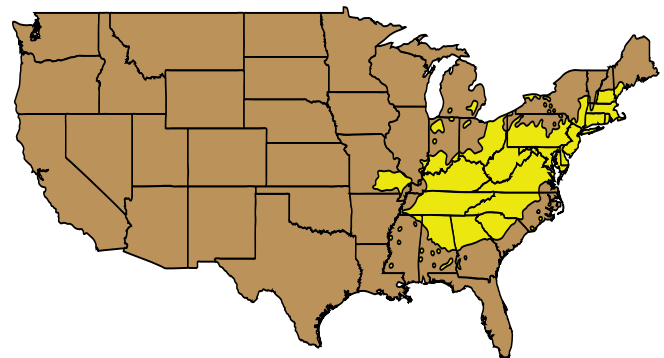
Range of the black oak



Range of the pin oak



Range of the northern red oak



Range of the scarlet oak





Chip Morrison

Board 1 is a wide and shows the beautiful light red color, coarse grain pattern, and a centered cathedral effect possible with red oak. The “U” or “V” shaped cathedral pattern is caused by cutting across the coarse growth rings. Pieces such as this one would be selected for specific applications.

Board 2 is somewhat darker in color. It has a small mineral spot in the center and diffuse mineral along the left edge. A small section of white sapwood is present on the upper right corner of the board.

Board 3 is quarter sawn and shows the ray flecks on the surface. The amount of fleck can vary substantially, and it can be difficult to see without actually looking at the board. Quartered and rift sawn oak are increasing in popularity.

Boards 4 and 5 are more typical of common red oak lumber. Widths will range mostly from 4 to 10 inches wide with scattered knots and some edge

wane or bark. An occasional dark mineral streak may be present. Small pin knots present at the bottom of Board 4 can be common in some trees. They are considered grading defects where clear parts are required; but in reality, they add character to many woodworking projects.

Board 5 shows small worm holes near the bottom. These are considered defects in lumber grading; but for certain applications, they could be quite decorative.

Board 7 is clear but shows a diffuse mineral stain spread throughout much of the piece. Board 6 shows two holes caused by a borer and a dark streaks of mineral stain that resulted from the invasion by the insect. The amount of mineral allowed is limited by the grading rule.

## PURDUE AGRICULTURE

NEW 9/07

It is the policy of the Purdue University Cooperative Extension Service that all persons have equal opportunity and access to its educational programs, services, activities, and facilities without regard to race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability or status as a veteran. Purdue University is an Affirmative Action institution. This material may be available in alternative formats.