



# **The Hardwood Handbook**

**An Illustrated Guide to Appalachian  
and Southern Lumber**

**Southeastern Lumber Manufacturers Association**

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The great southeastern hardwood forest is a miracle resource — beautiful, renewable and sustainable. It provides clean water, a habitat for a variety of wildlife species and a rich environment for recreation. And, since annual growth is almost double hardwood timber harvest, the forest is a perpetual provider of valuable products for home and industry.

The members of the Southeastern Lumber Manufacturers Association are family-owned businesses that depend on the land surrounding their local communities. As these family-owned businesses work to provide the products our society needs, they do so with a commitment to maintaining resources for future generations. SLMA members encourage proper reforestation and forest management and environmentally sound harvesting practices.

The solid wood products produced by SLMA members include a vast array of consumer and industrial products. Their products range from the quality oak, walnut and cherry lumber used in the finest solid wood furniture and mouldings to railroad crossties and bridge timbers.

The Hardwood Handbook is a practical guide for the consumer, builder, architect and other specifiers to select from the many beautiful hardwood species grown in vibrant and perpetual southeastern hardwood forests. Each species has its own distinct qualities, but all have the warm natural feel and charm that is uniquely wood.

When quality, renewability and warmth are required — choose wisely ... choose wood.

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*Compiled by the Southeastern Lumber Manufacturers Association, Inc. staff under the direction of the Hardwood Marketing Committee.*

*Photography: J.S. Garner and U.S. Forest Service.*

# INTRODUCTION

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## SOUTHEASTERN FOREST FACTS

The southeastern lumber industry relies on a renewable resource — trees — to make a variety of lumber products for shelter, furniture, industrial uses and other needs for the people of the Southeast, the nation and the world. Now, and even more so in the future, the world will look to the nation, and to the Southeast in particular, to meet the expanding demand for lumber and other forest products. Because of a vast forest of fast growing trees, advanced management, refined manufacturing techniques and excellent transportation facilities, we should be able to meet the demands for wood products domestically and for overseas consumption indefinitely.

Over 26 percent of the country's forested acres — some 194 million acres — is in the South. This land, and its timber resources, provide nearly half of the wood used in the pulp industry, almost a third of that used in the lumber industry and about two-fifths of that consumed in the veneer and plywood industry. The importance of the South as a source of timber has increased in recent years. Further, it appears that most of the expansion in the forest products industry will likely be based on the timber resources of the southeastern United States.

*Forest Statistics of the United States, 1992*, shows that the U.S. grows far more hardwood timber than is harvested each year. In fact, there are 82 percent more hardwoods now than there were 40 years ago. Total U.S. growing stock now amounts to over 336 billion cubic feet as compared to 180 billion cubic feet in 1952. Currently, the United States is growing almost twice as much hardwood sawtimber volume as is being used.

## THE FOREST PRODUCTS INDUSTRY AS ENVIRONMENTAL STEWARDS

Suppose America stopped harvesting its trees to make lumber and other wood products. Let's consider what effect this would have on our environment. What could we use as a building material for homes and furniture, or paper for books and stationery? Would we substitute steel, aluminum, masonry, or plastic products? Buy wood from other countries? Or do without?

If we substituted non-wood building products, the environment would be the clear loser. Those non-wood products are environmentally expensive. The supplies of ores and petroleum for their production are finite; once gone, they are gone forever. Wood, on the other hand, is a renewable resource from an endless succession of trees. Non-wood products require far more energy to manufacture than wood: nine times as much to make a steel stud as a wood stud for example. That further depletes finite supplies of fossil fuels and coal, not to mention greater pollution of the air and water while adding to the potential of global warming through the greenhouse effect.

Wood is reusable, recyclable, and biodegradable. Inorganic materials call for yet additional energy drains to recycle or otherwise dispose of them when use has been terminated.

Contrary to popular opinion, we are not running out of trees by harvesting so many of them. Each American does use the equivalent of a 100 foot, 18 inch diameter tree every year for wood and paper products. But 6 million trees are planted **every day**, which works out to nine trees for every American. Countless additional seedlings are regenerated naturally on managed lands. As a result, more wood is grown each year in

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the U.S. than is harvested and/or lost to disease, insects and fire. Growth exceeds harvest by 33 percent. It is no surprise, then, that the nation has more trees today than it had 70 years ago.

Forests are oxygen factories and greenhouse exchangers. Growing just one pound of wood in a vigorous younger forest removes 1.47 pounds of carbon dioxide from the atmosphere and replaces it with 1.07 pounds of life-sustaining oxygen. Carbon dioxide accounts for about half the world's greenhouse gases, which traps solar rays. An old forest reverses the process, removing oxygen and emitting carbon dioxide.

As long as America continues to plant and regenerate new trees for wood products, the environment will be the big winner. So in a very real sense, wood products are the most environmentally responsible building material available.

## **APPALACHIAN AND SOUTHERN HARDWOOD LUMBER**

Everyone is familiar with fine furniture manufactured from high-quality white oak, red oak, ash, walnut and cherry lumber which is grown and manufactured in the southeastern region. The unmatched warmth and traditional good looks of this furniture are unmistakable.

Although furniture manufacturing often takes the limelight in regard to hardwood lumber, many other categories consume vast amounts of hardwood lumber. For instance, billions of board feet of lumber are used each year in shipping (containers, wooden pallets, blocking and bracing). Wood pallets alone account for over 5 billion board feet of lumber within this category annually. Nearly a billion board feet of hardwood

lumber is used annually to manufacture millions of railroad crossties which are used in new construction and the maintenance of existing track.

Finally, millions of board feet of hardwood lumber are used each year in the manufacture of fine hardwood flooring, trim, paneling, and timbers.

## **ABOUT THIS BOOK**

### **1 Working Properties**

On page 6, we list 26 of the commonly produced lumber species grown within the southeastern region. This chart gives easy reference for most of the relative working properties for these listed species.

### **2 Physical Properties**

Pages 7 & 8 list specific gravity, average shipping weight, average shrinkage, modulus of rupture, modulus of elasticity, and side hardness. All these physical properties are listed in English and metric measurements.

### **3 General Description**

Beginning on page 12, we give a representative photographic sample of each listed species. In addition, the relative working properties and general narrative description of each species are provided adjacent to the photograph.

### **4 Glossary**

Pages 26-31 contain commonly used terminology associated with hardwood and softwood lumber products as derived from the USDA's Agriculture Handbook #72.

# RELATIVE WORKING PROPERTIES

Species	Machining	Resistance to Splitting in Nailing	Nail-Holding	Gluing
ASH	Excellent	Good	Excellent	Good
BASSWOOD	Very Good	Excellent	Good	Very Good
BEECH	Excellent	Fair	Fair	Good
BIRCH, Yellow	Excellent	Fair	Fair	Good
CHESTNUT	Excellent	Fair	Fair	Good
CHERRY	Excellent	Fair	Fair	Very Good
COTTONWOOD	Good	Excellent	Excellent	Excellent
CYPRESS, Southern	Very Good	Excellent	Excellent	Excellent
ELM, American	Very Good	Excellent	Excellent	Excellent
GUM, Sap, Red	Very Good	Good	Good	Very Good
HACKBERRY	Very Good	Good	Good	Excellent
HICKORY	Excellent	Fair	Good	Good
MAGNOLIA	Very Good	Good	Excellent	Very Good
MAPLE, Hard	Excellent	Fair	Good	Good
MAPLE, Soft	Very Good	Fair	Good	Good
OAK, Red	Excellent	Good	Excellent	Good
OAK, White	Excellent	Good	Excellent	Good
PECAN	Excellent	Fair	Good	Good
PINE, Southern	Good	Fair	Fair	Very Good
PINE, Heart	Good	Fair	Fair	Very Good
PINE, White	Excellent	Excellent	Excellent	Very Good
POPLAR, Yellow	Very Good	Excellent	Good	Excellent
SASSAFRAS	Excellent	Good	Good	Good
SYCAMORE	Very Good	Excellent	Excellent	Good
TUPELO, Black and Water	Very Good	Good	Good	Good
WALNUT, Black	Excellent	Fair	Good	Good
WILLOW, Black	Good	Excellent	Good	Excellent

Source: USDA Agricultural Handbook .72



# PHYSICAL PROPERTIES

English

Species	Specific Gravity (12% M.C.)	Avg. Shpg. Wt. Air Dry #/C.F.	Avg. Volumetric Shrkg. (Oven Dry % of Green)	Modulus of Rupture (psi)	Modulus of Elasticity (Million psi)	Side Hardness (lb.)
ASH, White	0.60	37	13.3	15,400	1.74	1,370
BASSWOOD	0.37	26	15.8	8,700	1.46	410
BEECH	0.64	44	17.2	14,900	1.72	1,300
BIRCH, Yellow	0.62	36	16.8	16,600	2.01	1,260
CHERRY, Black	0.50	36	11.5	12,300	1.49	950
CHESTNUT	0.43	31	8.2	8,600	1.23	540
COTTONWOOD	0.40	24	13.9	8,500	1.37	430
CYPRESS, Southern	0.46	30	10.5	10,600	1.44	510
ELM, American	0.50	35	14.6	11,800	1.34	830
ELM, Red	0.53	43	13.8	13,000	1.49	860
GUM, Sap, Red	0.52	36	15.8	12,500	1.64	850
HACKBERRY	0.53	50	13.8	11,000	1.19	880
HICKORY	0.72	53	17.8	20,200	2.16	1,800
MAGNOLIA	0.50	32	12.3	11,200	1.40	1,020
MAPLE, Hard	0.63	44	14.7	15,800	1.83	1,450
MAPLE, Soft	0.47	38	12.0	8,900	1.14	700
OAK, Red	0.63	47	16.1*	14,300	1.82	1,290
OAK, White	0.68	48	15.5*	15,200	1.78	1,360
PECAN	0.66	46	13.6	13,700	1.73	1,820
PINE, Southern	0.51	38	12.3*	12,800	1.79	690
PINE, Heart	0.59	45	12.3*	14,500	1.98	870
PINE, White	0.35	32	8.2	8,600	1.24	380
POPLAR, Yellow	0.42	26	12.7	10,100	1.58	540
SASSAFRAS	0.46	31	10.3	9,000	1.12	N/A
SYCAMORE	0.49	35	14.1	10,000	1.42	770
TUPELO, Black & Water	0.50	35	13.4*	9,600	1.20	810
WALNUT, Black	0.55	39	12.8	14,600	1.68	1,010
WILLOW, Black	0.39	32	13.9	780	1.01	N/A

\* Average

Source: USDA Agricultural Handbook .72

# PHYSICAL PROPERTIES

Metric

Species	Spec. Gravity (12% M.C.)	Avg. Shpg. Wt. Kilograms (kg) Per Cubic Meter (m <sup>3</sup> )		Avg. Volumetric Shrkg. (Oven Dry % of Green)	Modulus of Rupture (psi) (Kilopascals)	Modulus of Elas- ticity (Mil. psi) (Megapascals)	Side Hardness (Newtons)
		Green	Air Dry				
ASH, White	0.60	747	594	13.3	106,000	12,000	5,900
BASSWOOD	0.37	640	381	15.8	60,000	10,100	1,800
BEECH	0.64	869	610	17.2	103,000	11,900	5,800
BIRCH, Yellow	0.62	869	640	16.8	114,000	13,900	5,600
CHERRY, Black	0.50	793	625	11.5	55,000	9,000	2,900
CHESTNUT	0.43	823	457	8.2	39,000	6,400	1,900
COTTONWOOD	0.40	747	457	13.9	37,000	7,000	1,500
CYPRESS, Southern	0.46	625	484	10.5	73,300	9,900	2,200
ELM, American	0.50	762	488	14.6	81,000	9,200	3,700
ELM, Red	0.53	823	610	13.8	90,000	10,300	3,800
GUM, Sap, Red	0.52	838	533	15.8	86,000	11,300	3,800
HACKBERRY	0.53	747	533	13.8	76,000	8,200	3,900
HICKORY	0.72	945	716	17.8	139,000	14,900	7,000
MAGNOLIA	0.50	732	518	12.3	77,000	9,700	4,500
MAPLE, Hard	0.63	838	655	14.7	109,000	12,600	6,400
MAPLE, Soft	0.47	762	564	12.0	61,000	7,900	3,100
OAK, Red	0.63	884	640	16.1*	99,000	12,500	5,700
OAK, White	0.68	884	640	15.5*	105,000	12,300	6,000
PECAN	0.66	975	716	13.6	94,000	11,900	8,100
PINE, Southern	0.51	793	549	12.3*	88,000	12,300	3,100
PINE, Heart	0.59	939	650	12.3*	100,000	13,700	3,900
PINE, White	0.35	686	442	8.2	67,000	10,100	1,900
POPLAR, Yellow	0.42	701	488	12.7	70,000	10,900	2,400
SASSAFRAS	0.46	747	503	10.3	62,000	7,700	2,800
SYCAMORE	0.49	732	518	14.1	69,000	9,800	3,400
TUPELO, Black & Water	0.50	777	518	13.4*	66,000	8,300	3,600
WALNUT, Black	0.55	747	579	12.8	101,000	11,600	4,500
WILLOW, Black	0.39	610	457	13.9	54,000	7,000	2,800



# METRIC CONVERSIONS

IF YOU KNOW	AND WANT TO FIND	MULTIPLY BY
Inches	Millimeters	25.4
Inches	Centimeters	2.54
Millimeters	Inches	.03937
Centimeters	Inches	.3937
Feet	Meters	3.280
MBF, Full Sawn*	Cubic Meters	2.36
Cubic Meters	MBF, Full Sawn*	.424
MBF, Scribner Log Scale	Cubic Meters	4.52
Cubic Meters	MBF, Scribners	.221
MSF $\frac{3}{8}$ " Basis	Cubic Meters	.885
Cubic Meters	MSF, $\frac{3}{8}$ " Basis	1.13
Acres	Hectares	.4047
Hectares	Acres	2.4711

\*Nominal sawn lumber is usually converted to cubic measure by same factors. There are approximately 638 board feet of nominal sized lumber in a cubic meter, making the mathematically correct conversion factors 1.57 and .638.

## QUICK FORMULAS

1. If lumber is full sawn, or volume is computed on actual sizes, multiply the board footage expressed in thousands of board feet (MBF) by 2.358 to find cubic meters:

$$\text{MBF} \times 2.358 = \text{M}^3$$

2. If lumber volume is based upon nominal sizes, divide the actual cross section (thickness x width) by the nominal cross section (thickness x width), then multiply by 2.358. Multiply the total board footage (MBF) by this figure to find the total cubic meters:

$$\frac{\text{Actual Cross Section}}{\text{Nominal Cross Section}} \times 2.358 \times \text{MBF} = \text{M}^3$$

3. If the lumber is trimmed to a specified length, but billed on even foot basis, as in precision end-trimmed studs, then account for this difference by multiplying the total cubic meters by an additional factor. To find this factor, divide the actual trim length by the nominal length, then multiply the total cubic meters by this number:

$$\frac{\text{Actual Trim Length}}{\text{Nominal Length}} \times \text{M}^3 = \text{total M}^3$$

## QUICK LUMBER CONVERSIONS

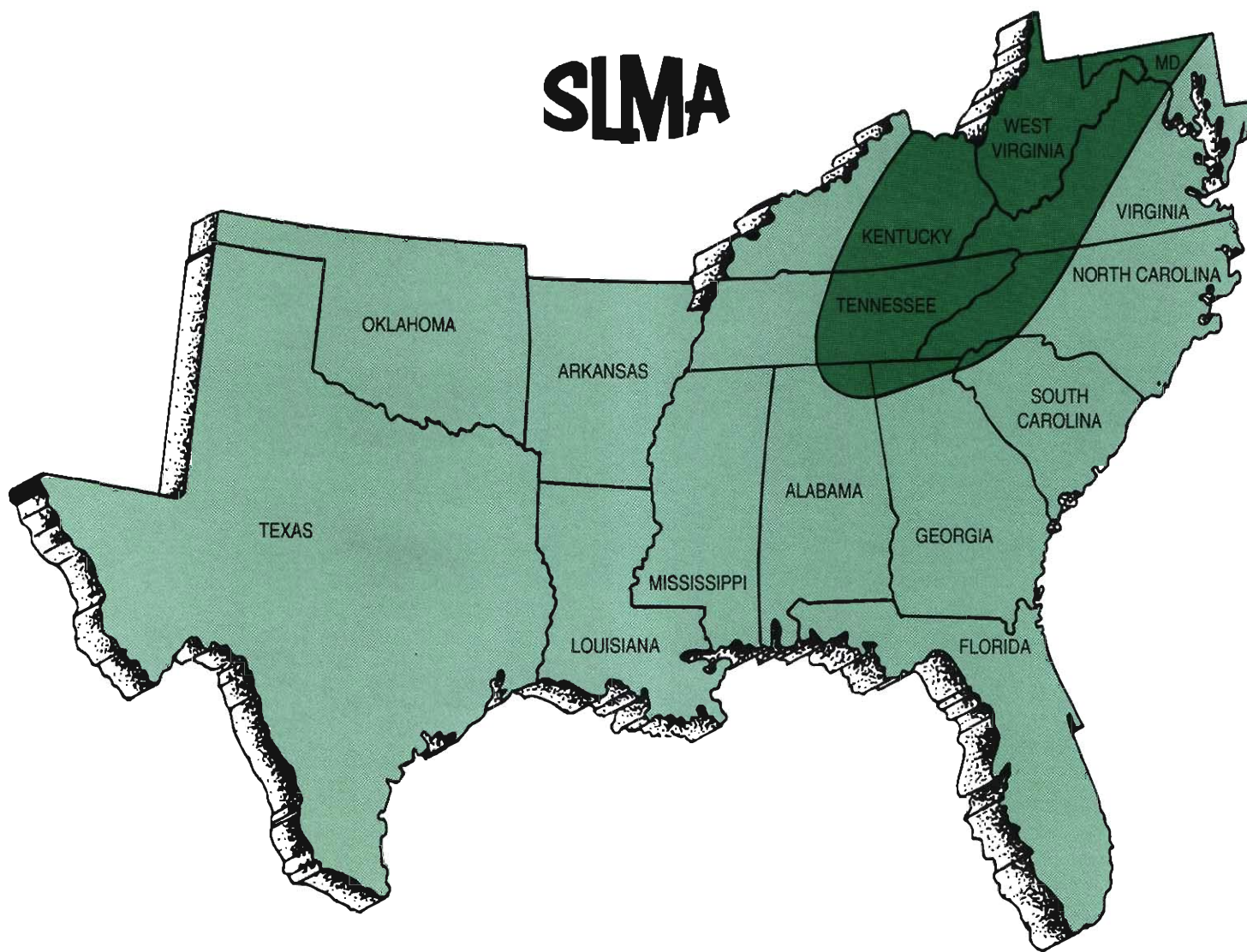
Inches  $\times$  25.4 = Millimeters  
 Feet  $\times$  .3048 = Meters  
 Cubic Feet  $\times$  .02832 = Cubic Meters

Millimeters  $\times$  .03937 = Inches  
 Meters  $\times$  3.28 = Feet  
 Cubic Meters  $\times$  35.314 = Cubic Feet

# COMMERCIAL FOREST REGIONS

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SLMA members are situated throughout the Southern and Appalachian forest regions generally depicted below. They produce a variety of solid wood products for domestic and export markets from the most diverse, productive and well managed hardwood forests in the world. Soils, topography and the longest growing season in the United States combine for abundant, high quality hardwood stands. The species described on the following pages grow in either or both regions. Please contact SLMA for a current listing of producers.



## LEGEND:

- Appalachian Region
- Southern Region







# ASH, WHITE

(*Fraxinus, americana, F. pennsylvanica*)



## RANGE:

The major species of ash grow in the eastern half of the United States.

## DESCRIPTION:

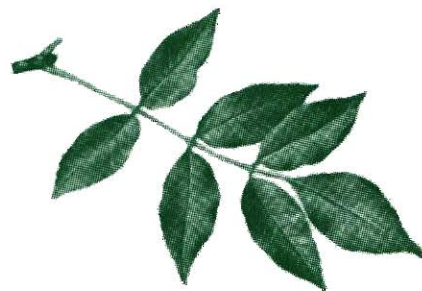
Commercial white ash is a group of species that consists mostly of white ash and green ash, although blue ash is also included. Heartwood of commercial white ash is brown; the sapwood is light colored or nearly white. Second-growth trees have a large proportion of sapwood. Old-growth trees, which characteristically have little sapwood, are scarce.

## PHYSICAL PROPERTIES:

Second-growth commercial white ash is particularly sought because of the inherent qualities of this wood; it is heavy (42lbs./cu.ft.), strong, hard, stiff, and has high resistance to shock.

## USES:

Ash is used for furniture, cooperage, handles, oars, vehicle parts, baseball bats, and other athletic goods.



# BASSWOOD

(*Tilia americana*)



## RANGE:

Basswood grows in the eastern half of the United States from the Canadian provinces southward.

## DESCRIPTION:

The heartwood of basswood is pale yellowish-brown with occasional darker streaks. Basswood has wide, creamy-white or pale brown sapwood that merges gradually into the heartwood.

## PHYSICAL PROPERTIES:

When dry, the wood is without odor or taste. It is soft and light in weight (26lbs./cu.ft.), has fine, even texture, is straight-grained and easy to work with tools. Shrinkage in width and thickness during drying is rated as large; however, basswood seldom warps in use.

## USES:

Basswood lumber is used mainly in sash and door frames, moulding, woodenware, and boxes.

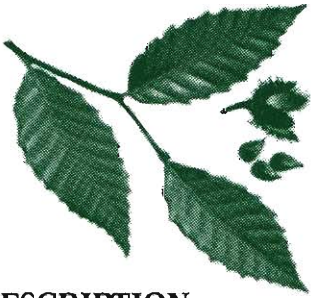




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# BEECH, AMERICAN

(*Fagus grandifolia*)



## RANGE:

Only one species of beech, American beech, is native to the United States. It grows in the eastern one-third of the United States and adjacent Canadian provinces.

## DESCRIPTION:

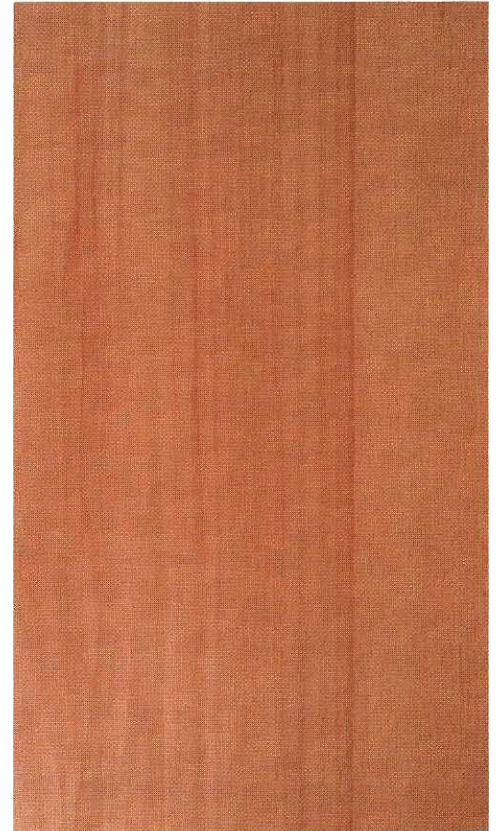
Beech varies in color from nearly white sapwood to reddish-brown heartwood in some trees. Sometimes there is no clear line of demarcation between heartwood and sapwood. Sapwood may be 3 to 5 inches thick. The wood has little figure and is of close, uniform texture. It has no characteristic taste or odor.

## PHYSICAL PROPERTIES:

The wood of beech is classed as heavy (44lbs./cu.ft.), hard, strong, high in resistance to shock, and highly suitable for steam bending. Beech shrinks substantially and therefore requires careful drying. It machines smoothly, is an excellent wood for turning, wears well, and is rather easily treated with preservatives. Easy to stain, paint or bleach.

## USES:

Largest amounts of beech go into flooring, furniture, handles, veneer, woodenware, containers, cooperage, and laundry appliances. When treated, it is suitable for railway ties.



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# BIRCH, YELLOW

(*Betula alleghaniensis*)



## RANGE:

The important species of birch are yellow birch, and sweet birch (*Betula lenta*). Yellow and sweet birch grow along the Appalachian Mountains to northern Georgia. They are the source of most birch lumber and veneer.

## DESCRIPTION:

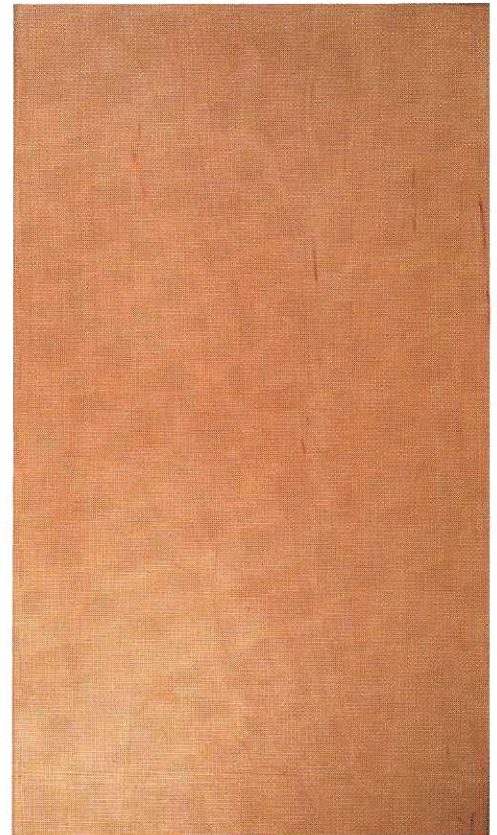
Yellow birch has white sapwood and light reddish-brown heartwood. Sweet birch has light-colored sapwood and dark brown heartwood tinged with red.

## PHYSICAL PROPERTIES:

Wood of yellow birch and sweet birch is heavy (36lbs./cu.ft.), hard, strong, and has good shock-resisting ability. The wood is fine and uniform in texture.

## USES:

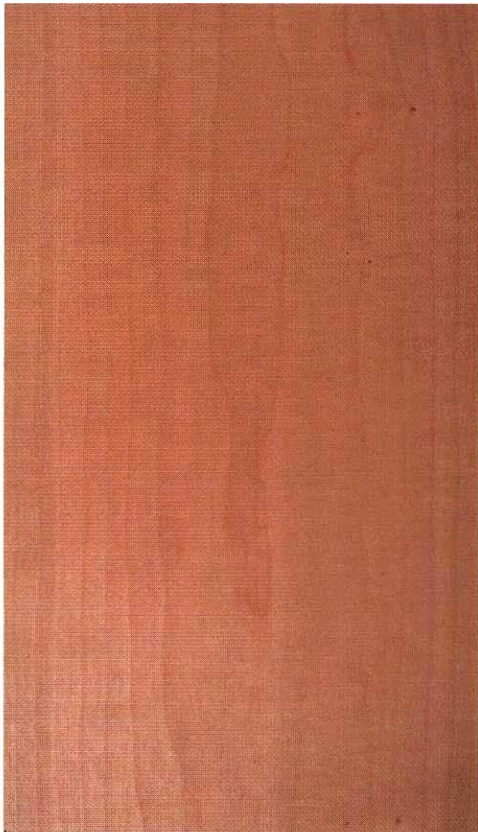
Yellow and sweet birch lumber and veneer go principally into the manufacture of furniture, boxes, baskets, crates, woodenware, cooperage, interior finish, and doors. Birch veneer goes into plywood used for doors, furniture, paneling, radio and television cabinets, aircraft, and other specialty uses.





# CHERRY, BLACK

(*Prunus serotina*)



## RANGE:

Black cherry is sometimes known as cherry, wild black cherry, or wild cherry. It is the only native species of the genus *Prunus* of commercial importance for lumber production. It is scattered from southeastern Canada throughout the eastern half of the United States.

## DESCRIPTION:

The heartwood of black cherry varies from light to dark reddish-brown and has a distinctive luster. The sapwood is narrow in old trees and nearly white.

## PHYSICAL PROPERTIES:

The wood has a fairly uniform texture and very good machining properties. It is moderately heavy (36lbs./cu.ft.), strong, stiff, moderately hard, has high shock-resistance, and moderately large shrinkage. After seasoning, it is very stable dimensionally.

## USES:

Black cherry is used principally for furniture, fine veneer panels and architectural woodwork. Other uses include caskets, woodenware, novelties, patterns, and paneling.



# CHESTNUT

(*Castanea dentata*)



## RANGE:

Before American chestnut was attacked by a fungus blight, it grew in commercial quantities from New England to northern Georgia. Practically all standing chestnut has been killed by blight, and most supplies come from dead timber. Although there are very limited quantities in the Appalachian Mountains, chestnut logs are available because of natural resistance to decay.

## DESCRIPTION:

The heartwood of chestnut is grayish-brown or brown and becomes darker with age. The sapwood is very narrow and almost white.

## PHYSICAL PROPERTIES:

The wood is coarse in texture; the growth rings are made conspicuous by several rows of large, distinct pores at the beginning of each year's growth. Chestnut wood is moderately light in weight (31lbs./cu.ft.), moderately hard, moderately low in strength, moderately low in resistance to shock, and low in stiffness. It seasons well and is easy to work with tools.

## USES:

Chestnut was used for poles, railroad cross-ties, furniture, caskets, boxes, crates, and core stock for veneer panels. It appears most frequently now as "wormy chestnut" for paneling, trim and picture frames.

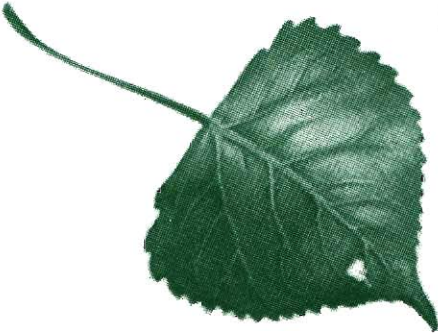




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# COTTONWOOD

(*Populus deltoides*)



## RANGE:

Cottonwood includes several species of the genus *Populus*. Most important is eastern cottonwood (*P. deltoides* and varieties). Eastern cottonwood and swamp cottonwood grow throughout the eastern half of the United States. Greatest production of lumber is in the Southern and Central states.

## DESCRIPTION:

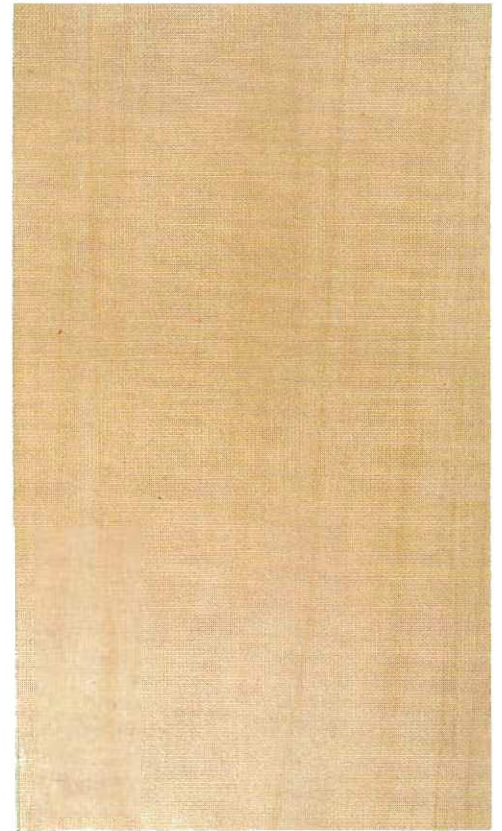
The heartwood of cottonwood is grayish-white to light brown. The sapwood is whitish and merges gradually with the heartwood.

## PHYSICAL PROPERTIES:

The wood is comparatively uniform in texture, and generally straight-grained. It is odorless when well-seasoned. Eastern cottonwood is moderately low in bending and compressive strength, moderately stiff, moderately soft, and moderately low in ability to resist shock. Eastern cottonwood has moderately large shrinkage and light in weight (24lbs./cu.ft.).

## USES:

Some cottonwood is difficult to work with tools because of fuzzy surfaces. Tension wood is largely responsible for this characteristic. Cottonwood lumber and veneer go largely into boxes, crates, baskets, and plates.



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# ELM

(*Ulmus spp.*)



## RANGE:

Six species of elm grow in the eastern United States: American elm, slippery elm, rock elm, winged elm, cedar elm, and September elm. The supply of American elm is threatened by two diseases, Dutch Elm and

phloem necrosis, which have killed hundreds of thousands of trees. American elm is also known as white elm, water elm, and gray elm. Slippery elm is also known as red elm, or basket elm.

## DESCRIPTION:

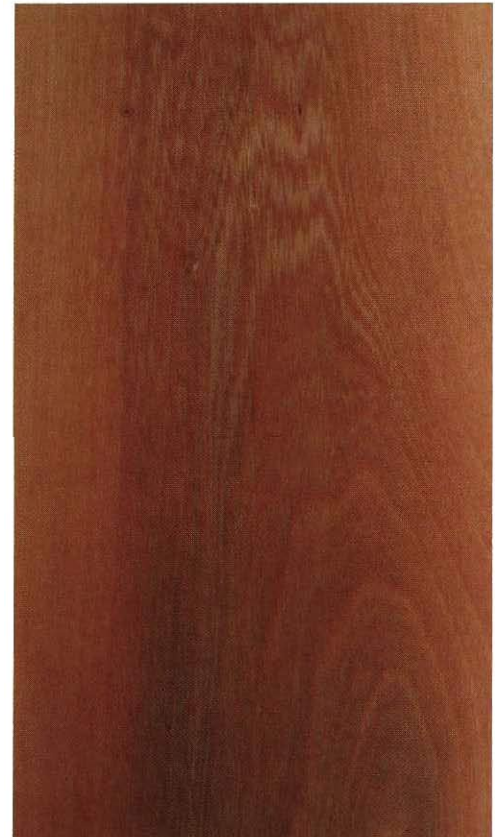
The sapwood of the elms is nearly white and the heartwood light brown, often tinged with red.

## PHYSICAL PROPERTIES:

The elms may be divided into two general classes, hard elm and soft elm, based on the weight and strength of the wood. Soft elm is moderately heavy, has high shock resistance, and is moderately hard and stiff. Hard elm species are somewhat heavier than soft elm. Elm has excellent bending qualities.

## USES:

Elm lumber is used principally in boxes, baskets, crates, and slack barrels; furniture, agricultural supplies and implements; caskets and burial boxes; and vehicles. The hard elms are preferred for some uses where more strength is required.

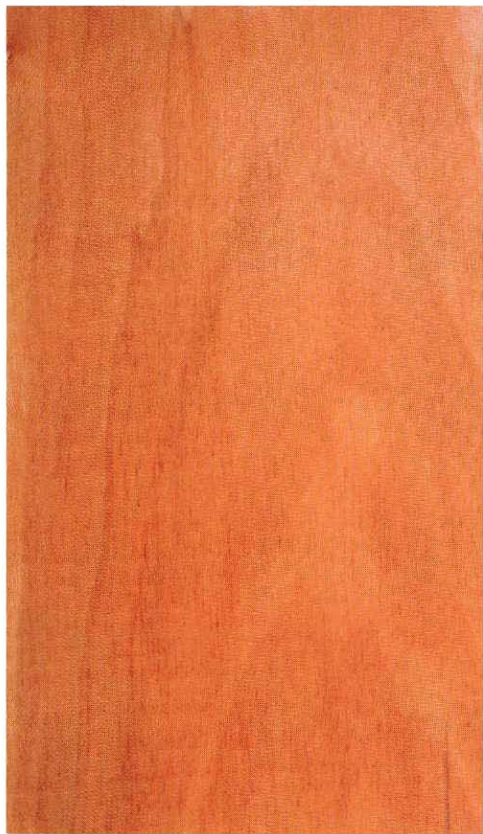




# GUM – Sap Gum, Red Gum

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(*Liquidambar styraciflua*)



## RANGE:

Sweetgum grows from southwestern Connecticut westward into Missouri and southward to the Gulf. Lumber production is almost entirely from the Southern and South Atlantic states.

## DESCRIPTION:

The lumber from sweetgum is usually divided into two classes — sap gum, the light-colored wood from the sapwood, and red gum, the reddish-brown heartwood.

## PHYSICAL PROPERTIES:

Sweetgum often has interlocked grain and must be carefully dried. When quartersawn, the interlocked grain produces a ribbon stripe that is desirable for interior finish and furniture. The wood is rated as moderately heavy (36lbs./cu.ft.), and hard, moderately strong, moderately stiff, and moderately high in shock resistance.

## USES:

Sweetgum is used mainly for lumber, plywood, and railroad cross-ties. The lumber goes principally into boxes and crates, furniture, interior trim, and millwork.



# HACKBERRY

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(*Celtis occidentalis*)



## RANGE:

Hackberry and sugarberry (*C. laevigata*) supply the lumber known in the trade as hackberry. Hackberry grows east of the Great Plains from Alabama, Georgia, Arkansas, and Oklahoma northward, except along the Canadian boundary. Sugarberry overlaps the southern part of the range of hackberry and grows throughout the Southern and South Atlantic states.

## DESCRIPTION:

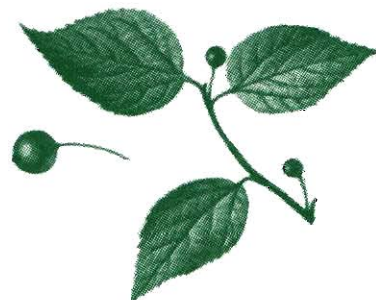
The sapwood of both species varies from pale yellow to greenish or grayish-yellow. The heartwood is commonly darker. The wood resembles elm in structure.

## PHYSICAL PROPERTIES:

Hackberry lumber is moderately heavy (50lbs./cu.ft.), moderately strong in bending, moderately weak in compression parallel to the grain, moderately hard to hard, high in shock resistance, low in stiffness, moderately large to large shrinkage, but keeps its shape well during seasoning.

## USES:

Most hackberry is cut into lumber, with small amounts going into dimension stock and some into veneer. Most of it is used for furniture and some for containers.

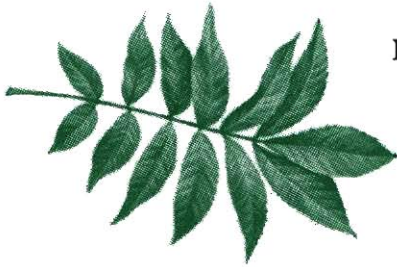




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# HICKORY/PECAN

(*Carya* spp.)



## RANGE:

True hickories are found throughout most of the eastern half of the United States. The species most important commercially are shagbark, pignut, shellbark, and mockernut. The Southern and South Atlantic states produce nearly

half of all hickory lumber. Species of the pecan group include bitternut hickory, pecan, water hickory, and nutmeg hickory.



## DESCRIPTION:

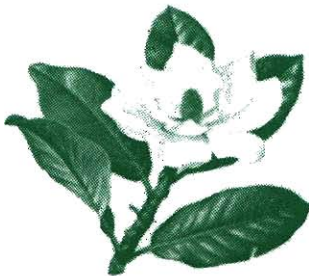
The sapwood of hickory is white and usually quite thick, except in old, slow-growing trees. The heartwood is reddish. The wood of pecan resembles that of true hickory.

## PHYSICAL PROPERTIES:

The wood of hickory and pecan is exceptionally tough, heavy, hard, strong, and shrinks considerably in drying.

## USES:

The wood of true hickory is used for tool handles, ladder rungs, athletic goods, agricultural implements, dowels, gymnasium apparatus, poles and furniture. Knotted, low grade hickory is useful for pallets and similar items. Hickory sawdust, chips, and some solid wood are used to flavor meat by smoking.



## RANGE:

Commercial magnolia comprises three species — southern magnolia, sweetbay (*M. virginiana*), and cucumbertree (*M. acuminata*). The lumber produced by all three is simply called magnolia. The natural range of sweetbay extends along

the Atlantic and Gulf coasts from Long Island to Texas, and that of southern magnolia from North Carolina to Texas. Cucumbertree grows from the Appalachians to the Ozarks northward to Ohio.

## DESCRIPTION:

The sapwood of southern magnolia is yellowish-white, and the heartwood is light to dark brown with a tinge of yellow or green. The wood, which has close, uniform texture and is generally straight-grained, closely resembles yellow poplar.

## PHYSICAL PROPERTIES:

The wood of magnolia is moderately heavy (32lbs./cu.ft.), moderately low in shrinkage, moderately low in bending and compressive strength, moderately hard and stiff, and moderately high in shock resistance.

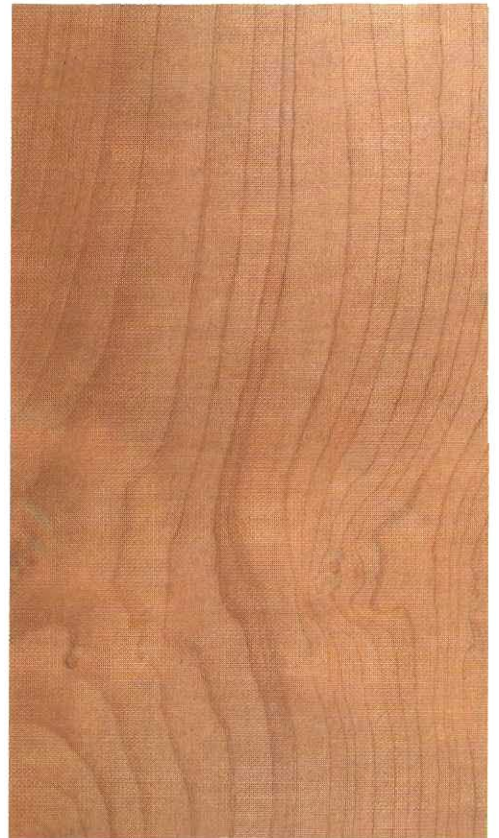
## USES:

Magnolia lumber is used principally in the manufacture of furniture, boxes, pallets, sash, doors, veneer, and millwork.

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# MAGNOLIA

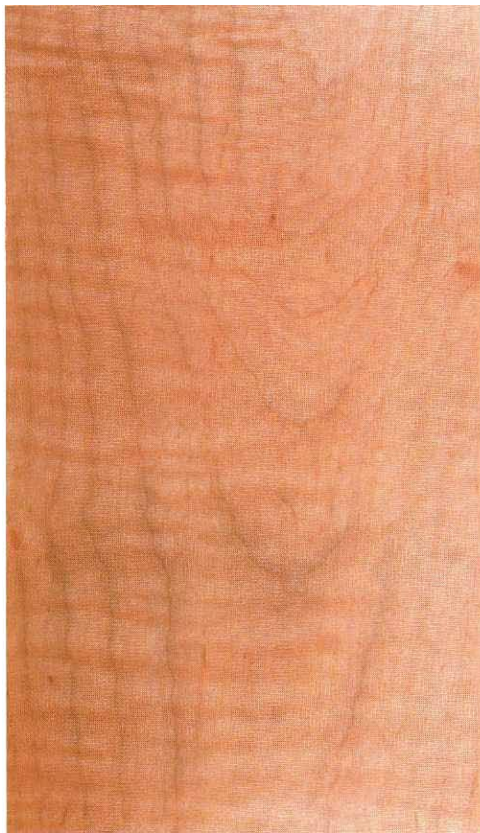
(*Magnolia grandiflora*)





# MAPLE, HARD – Sugar Maple, Black Maple

(*Acer saccharum*, *A. nigrum*)



## RANGE:

Five of the 13 species of maple native to the United States are important timber trees. Two are in the hard maple category, three are in the soft maple category.

## DESCRIPTION:

The two hard maples are sugar maple and black maple. Black maple grows in the upper Mississippi Valley while sugar maple grows in the Eastern U.S. excluding the southeastern coastal plains.

## PHYSICAL PROPERTIES:

The wood of all hard maples is similar. It has a cream to light reddish-brown colored heartwood, with a thin white sapwood tinged slightly with reddish-brown. The wood is heavy (44lbs./cu.ft.), strong, stiff, and has high shock resistance. Shrinkage during seasoning is large. It takes stain satisfactorily and polishes well. Although usually straight-grained, maple occasionally has a curly, wavy or birdseye grain.

## USES:

Used for lumber, wall paneling, flooring, furniture, handles, interior finish, cabinets, woodenware, and novelties.



# MAPLE, SOFT – Red Maple, Silver Maple

(*Acer rubrum*, *A. saccharinum*)



## RANGE:

The three maples that comprise the soft maple category are: red maple, silver maple, and boxelder (*A. negundo*). In general, all three species grow throughout the Eastern United States.

## DESCRIPTION:

The heartwood is usually light reddish-brown, but sometimes considerably darker. The sapwood is commonly white with a slight reddish-brown tinge.

## PHYSICAL PROPERTIES:

The wood of all the soft maples is similar. Although 25 percent softer than hard maple, soft maple is suited to most of the same uses. The wood possesses about the same finishing properties as hard maple and is suited for enamel finishes and brown tones. Soft maple is moderately heavy (38lbs./cu.ft.).

## USES:

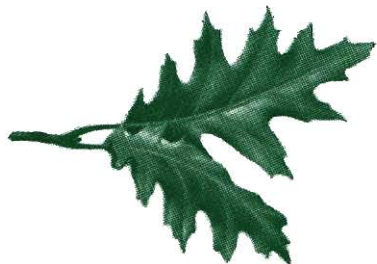
A large portion is used for flooring, furniture, pallets and crates, shoe lasts, handles, woodenware, spools, bobbins and novelties.





# OAK RED

(*Quercus* spp.)



## RANGE:

Most red oak comes from the Southern states, the Southern mountain regions, the Atlantic coastal plains, and the Central states. The principal species are: northern red oak, scarlet oak, Shumard oak,

pin oak, Nuttall oak, black oak, southern red oak, cherrybark oak, water oak, laurel oak, and willow oak.

## DESCRIPTION:

The sapwood is nearly white and usually 1 to 2 inches thick. The heartwood is brown with a tinge of red. Sawed lumber of red oak cannot be separated by species on the basis of the characteristics of the wood alone. Red oak lumber can be separated from white oak by the size and arrangement of pores in latewood and because, as a rule, it lacks tyloses in the pores. The open pores of red oaks make them unsuitable for tight cooperage.

## PHYSICAL PROPERTIES:

Wood of red oak is heavy (47lbs./cu.ft.). Rapidly grown second-growth oak is generally harder and tougher than finer textured old-growth timber, and shrinkage in drying is fairly large.

## USES:

The wood of red oak is largely cut into lumber, railroad crossties, and veneer. It is remanufactured into flooring, furniture, general millwork, boxes, pallets, and crates, agricultural implements, caskets, woodenware, handles, and railroad cars and boats.



# OAK, WHITE

(*Quercus* spp.)



## RANGE:

White oak lumber comes chiefly from the South, South Atlantic, and central states, including the Southern Appalachian area. Principal species are: white oak, chestnut oak, post oak, overcup oak, swamp chestnut oak, bur oak, chinkapin oak, swamp white oak, and live oak.

## DESCRIPTION:

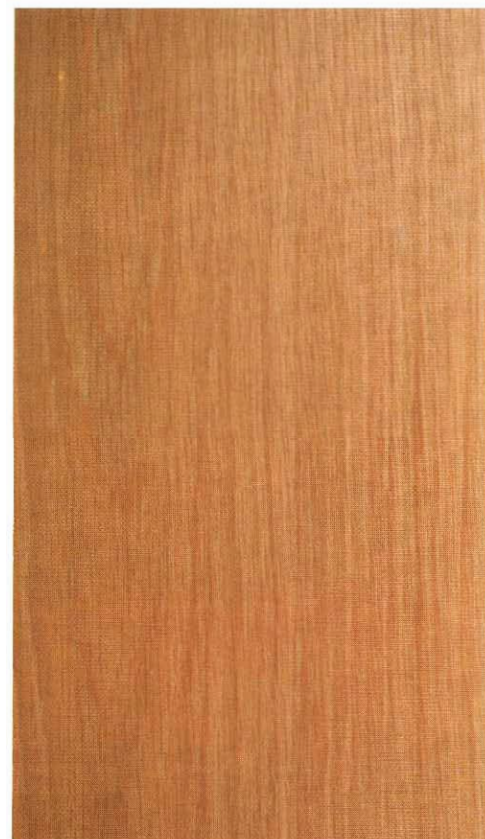
The heartwood is generally grayish-brown, and the sapwood, which is from 1 to 2 or more inches thick, is nearly white. The pores of the heartwood are usually plugged with tyloses. This tends to make the wood impenetrable by liquids. It is therefore suitable for tight cooperage.

## PHYSICAL PROPERTIES:

The wood of white oak is heavy (48lbs./cu.ft.), averaging somewhat higher in weight than that of red oak. The heartwood has moderately good decay resistance.

## USES:

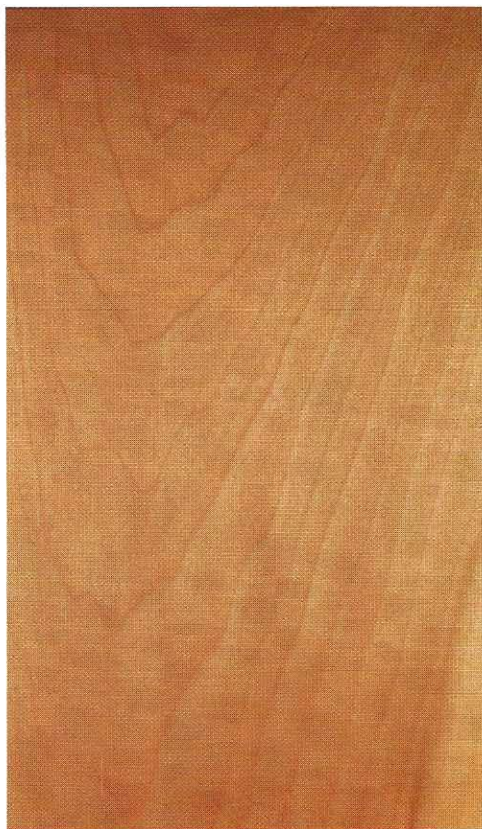
White oak is used for furniture, railroad crossties, cooperage, mine timbers, flooring, pallets, railroad cars, millwork and many other products. An important use of white oak is for planking and bent parts of ships and boats, heartwood often being specified because of its decay resistance.





# POPLAR, YELLOW

(*Liriodendron tulipifera*)



## RANGE:

Yellow poplar is also known as poplar and tulip poplar and grows from Connecticut and New York southward to Florida and westward to Missouri. The greatest commercial production of yellow poplar lumber is in the South.

## DESCRIPTION:

The sapwood is white and frequently several inches thick. The heartwood is yellowish-brown, sometimes streaked with purple, green, black, blue, or red. These colorations do not affect the physical properties of the wood.

## PHYSICAL PROPERTIES:

The wood is generally straight-grained and comparatively uniform in texture. It has moderately large shrinkage when dried from a green condition, but is not difficult to season and stays in place well after seasoning.

## USES:

Lumber goes mostly into furniture, interior finish, siding, and structural components. Boxes, pallets, and crates are made of lower grade stock.



# SASSAFRAS

(*Sassafras albidum*)



## RANGE:

The range of sassafras covers most of the eastern half of the United States from southeastern Iowa and eastern Texas eastward.

## DESCRIPTION:

The wood of sassafras is easily confused with black ash, with resemblance in color, grain, and texture. The sapwood is light yellow and the heartwood varies from dull grayish-brown to dark brown, sometimes with a reddish tinge. The wood has a distinct odor on freshly cut surfaces.

## PHYSICAL PROPERTIES:

Sassafras is moderately heavy (31lbs./cu.ft.), moderately hard, moderately weak in bending and endwise compression, quite high in shock resistance, and quite durable when exposed to conditions conducive to decay.

## USES:

It was highly prized by the Indians for dugout canoes, and some sassafras lumber is now used for small boats. It is also used in limited quantities as paneling and general millwork.





# SYCAMORE

(*Platanus occidentalis*)



## RANGE:

American sycamore grows from Maine to Nebraska, southward to Texas, and eastward to Florida.

## DESCRIPTION:

The heartwood of sycamore is reddish-brown and the sapwood is lighter in color and normally 1½ to 3 inches thick.

## PHYSICAL PROPERTIES:

The wood has fine texture and interlocked grain. It shrinks moderately in drying. Sycamore wood is moderately heavy (35lbs./cu.ft.), moderately hard, moderately stiff, moderately strong, and has good resistance to shock.

## USES:

Sycamore is used principally for lumber, veneer and railroad cross-ties. Sycamore lumber is used for furniture, boxes (particularly small food containers), pallets, flooring, handles, and butcher's blocks. Veneer is used for fruit and vegetable baskets, decorative panels and door skins.



# TUPELO, BLACK & WATER

(*Nyssa sylvatica*, *N. aquatica*)



## RANGE:

Tupelo includes water tupelo and black tupelo or blackgum. Water tupelo grows principally in the coastal regions of the Southeastern U.S. and along the lower Mississippi Valley. Black tupelo grows in the Eastern U.S. from Maine to Texas and Missouri. About two-thirds of the production of tupelo lumber is from the Southern states.

## DESCRIPTION:

Wood of the different tupelos is quite similar in appearance and properties. Heartwood is light brownish-gray and merges gradually into the lighter colored sapwood, which is generally several inches wide.

## PHYSICAL PROPERTIES:

The wood has fine, uniform texture and interlocked grain. Tupelo wood is rated as moderately heavy (35lbs./cu.ft.), moderately strong, moderately hard and stiff, and moderately high in shock resistance. Because of interlocked grain, tupelo lumber requires care in drying.

## USES:

Tupelo is cut principally as lumber for boxes, pallets, crates, baskets, and furniture. It is also used in railway ties and as pulp.





# WALNUT, BLACK

(*Juglans nigra*)



## RANGE:

Black walnut's natural range extends from Vermont to the Great Plains and southward into Louisiana and Texas. About three-quarters of the walnut timber is produced in the Central states.

## DESCRIPTION:

The heartwood of black walnut varies from light to dark brown, and the sapwood is nearly white and up to 3 inches wide in open-grown trees.

## PHYSICAL PROPERTIES:

Black walnut is normally straight-grained, easily worked with tools, and stable in use. It is heavy (39lbs./cu.ft.), hard, strong, stiff, and has good resistance to shock. Black walnut is well suited for natural finishes.

## USES:

Because of its properties and interesting grain pattern, black walnut is used for furniture, architectural woodwork, decorative panels, gunstocks, cabinets, and interior finish.



# WILLOW, BLACK

(*Salix nigra*)



## RANGE:

Black willow is the most important of the many willows that grow in the United States. It is the only one to supply lumber to the market under its own name. Most black willow is produced in the Mississippi Valley from Louisiana to southern Missouri and Illinois.

## DESCRIPTION:

The heartwood of black willow is grayish-brown or light reddish-brown frequently containing darker streaks. The sapwood is whitish to creamy yellow.

## PHYSICAL PROPERTIES:

The wood of black willow is uniform in texture, with somewhat interlocked grain. The wood is light in weight (32lbs./cu.ft.), and is moderately soft and moderately high in shock resistance. It has moderately large shrinkage.

## USES:

Willow is cut principally into lumber. Black willow lumber is remanufactured principally into boxes, pallets, crates, caskets, and furniture.









# BALDCYPRESS

(*Taxodium distichum*)



## RANGE:

Baldcypress is commonly known as southern cypress. About one-half of cypress lumber comes from the Southern states. It is not as readily available as it was several decades ago.

## DESCRIPTION:

The sapwood is narrow and nearly white. The heartwood color varies, ranging from light yellowish-brown to dark brownish-red, brown, or chocolate.

## PHYSICAL PROPERTIES:

The wood is moderately heavy (30lbs./cu.ft.), moderately strong, moderately hard, and moderately small in shrinkage. The heartwood of old-growth timber is one of our most decay-resistant woods, but second-growth timber is only moderately decay resistant.

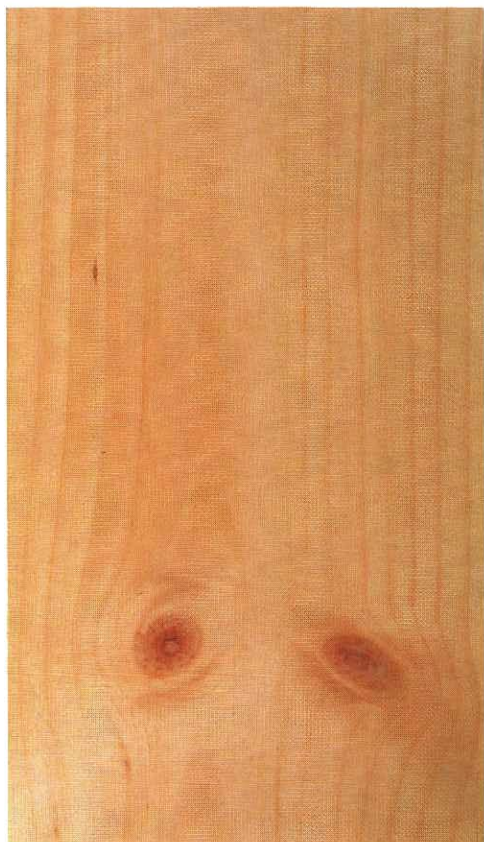
## USES:

Baldcypress has been used principally for building, siding and porch construction. It is also used for caskets, sash, doors, blinds, and general millwork, including interior trim and paneling, and shingles. Other uses include tanks, vats, ship and boat building, refrigerators, railroad cars, greenhouses, and cooling towers.



# PINE, EASTERN WHITE

(*Pinus strobus*)



## RANGE:

Eastern white pine grows from Maine to northern Georgia and in the lake states. It is also known as white pine.

## DESCRIPTION:

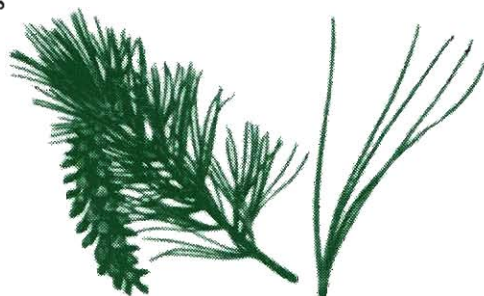
The heartwood of eastern white pine is light brown, often with a reddish tinge. It turns considerably darker on exposure. The wood has comparatively uniform texture and is straight-grained. It is easily kiln dried, has small shrinkage, and ranks high in stability. It is also easy to work and can be readily glued.

## PHYSICAL PROPERTIES:

Eastern white pine is light in weight, moderately soft, moderately low in strength, and low in resistance to shock.

## USES:

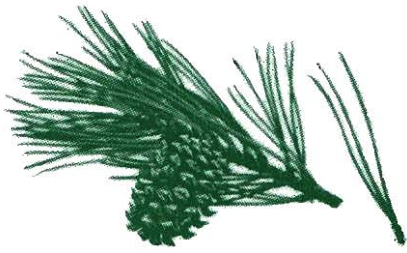
Practically all eastern white pine is converted into lumber, which is put to a great variety of uses. A large proportion which is mostly second-growth knotty lumber of the lower grades, goes into container and packaging applications. Higher grades are used in sash, doors, furniture, trim, knotty paneling, finish, toys, and dairy and poultry supplies.





# PINE, SOUTHERN

(*Pinus spp.*)

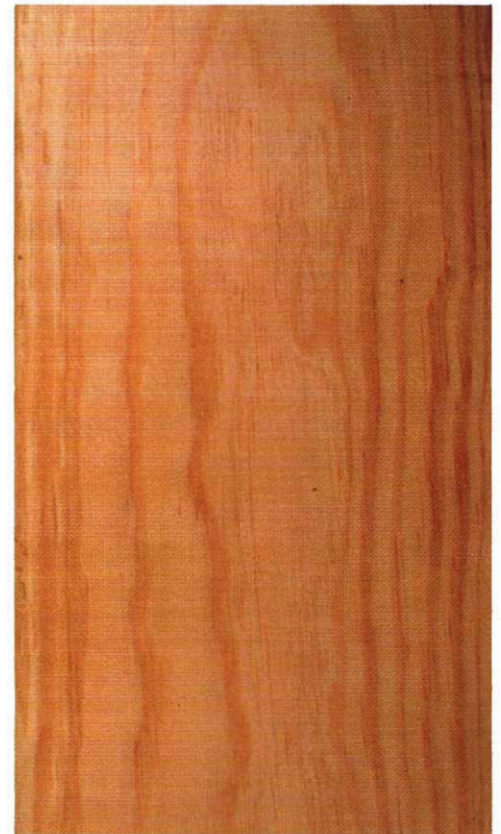


## RANGE:

A number of species are included in the group marketed as southern pine lumber. The four major southern pines, and their growth range are:

1. Longleaf pine (*P. palustris*), grows from eastern North Carolina southward into Florida and westward into eastern Texas.
2. Shortleaf pine (*P. echinata*), grows from southeastern New York and New Jersey southward to northern Florida and westward into eastern Texas and Oklahoma.
3. Loblolly pine (*P. taeda*), grows from Maryland southward through the Atlantic Coastal Plain and Piedmont Plateau into Florida and westward into eastern Texas.
4. Slash pine (*P. elliotii*), grows in Florida and the southern parts of South Carolina, Georgia, Alabama, Mississippi, and Louisiana east of the Mississippi River.

Lumber from any one or from any mixture of two or more of these species is classified as southern pine by the grading standards of the industry.



## Heart Pine

(*Pinus spp.*)

## DESCRIPTION:

The wood of the southern pines is quite similar in appearance. The sapwood is yellowish-white and the heartwood reddish-brown. The sapwood is usually wide in second-growth stands. Heartwood begins to form when the tree is about 20 years old. In old, slow-growth trees, sapwood may be only 1 to 2 inches in width.

## PHYSICAL PROPERTIES:

Longleaf and slash pine are classed as heavy (38-45lbs./cu.ft.), strong, stiff, hard, and moderately high in shock resistance. Shortleaf and loblolly pine are usually somewhat lighter in weight than longleaf. All the southern pines have moderately large shrinkage, but are stable when properly seasoned.

## USES:

The denser and higher strength southern pine is used extensively in construction of houses, factories, warehouses, bridges, trestles, and docks in the form of stringers, and for roof trusses, beams, posts, joists, and piles. Other clear grades of southern pine are used for furniture, millwork paneling, finish and a number of other specialty items. Lumber of lower grades is used in boxes, pallets, and crates. Southern pine is easily treated with preservatives and is used as pilings, poles, decking and fencing.



# GLOSSARY

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**Annual Growth Ring.** The layer of wood growth put on a tree during a single growing season. In the temperate zone the annual growth rings of many species (e.g., oaks, and pines) are readily distinguished because of differences in the cells formed during the early and late parts of the season. In some temperate zone species (black gum and sweetgum) and many tropical species, annual growth rings are not easily recognized.

**Bark Pocket.** An opening between annual growth rings that contains bark. Bark pockets appear as dark streaks on radial surfaces and as rounded areas on tangential surfaces.

**Bird Peck.** A small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. In shape, bird peck usually resembles a carpet tack with the point towards the bark; bird peck is usually accompanied by discoloration extending for considerable distance along the grain and to a much lesser extent across the grain.

**Birdseye.** Small localized areas in wood with the fibers indented and otherwise contorted to form few to many small circular or elliptical figures remotely resembling birds' eyes on the tangential surface. Sometimes found in sugar maple and used for decorative purposes; rare in other hardwood species.

**Board Foot.** A unit of measurement of lumber represented by a board 1 foot long, 12 inches wide, and 1 inch thick or its cubic equivalent. In practice, the board foot calculation for lumber 1 inch or more in thickness is based on its nominal thickness and width and the actual length. Lumber with a nominal thickness of less than 1 inch is calculated as 1 inch.

**Bow.** The distortion of lumber in which there is a deviation, in a direction perpendicular to the flat face, from a straight line from end-to-end of the piece.

**Burl.** (1) A hard, woody outgrowth on a tree, more or less rounded in form, usually resulting from the entwined growth of a cluster of adventitious buds. Such burls are the source of the highly figured burl veneers used for purely ornamental purposes. (2) In lumber or veneer, a localized severe distortion of the grain generally rounded in outline, usually resulting from overgrowth of dead branch stubs, varying from ½ inch to several inches in diameter; frequently includes one or more clusters of several small contiguous conical protuberances, each usually having a core or pith but no appreciable amount of end grain (in tangential view) surrounding it.

**Cambium.** A thin layer of tissue between the bark and wood that repeatedly subdivides to form new wood and bark cells.

**Cant.** A log that has been slabbed on one or more sides. Ordinarily, cants are intended for resawing at right angles to their widest sawn face. The term is loosely used. (See **Flitch**.)

**Cell.** A general term for the anatomical units of plant tissue, including wood fibers, vessel members, and other elements of diverse structure and function.

**Cellulose.** The carbohydrate that is the principal constituent of wood and forms the framework of the wood cells.

**Check.** A lengthwise separation of the wood that usually extends across the rings of annual growth and commonly results from stresses set up in wood during seasoning.

**Compression Wood.** Abnormal wood formed on the lower side of branches and inclined trunks of softwood trees. Compression wood is identified by its relatively wide annual rings (usually eccentric when viewed on cross section of branch or trunk), relatively large amount of summerwood, sometimes more than 50 percent of the width of the annual rings in which it occurs, and its lack of demarcation between earlywood and latewood in the same annual rings. Compression wood shrinks excessively lengthwise, as compared with normal wood.

**Conditioning** (pre and post). The exposure of a material to the influence of a prescribed atmosphere for a stipulated period of time or until a stipulated relation is reached between material and atmosphere.

**Cooperage.** Containers consisting of two round heads and a body composed of staves held together with hoops, such as barrels and kegs.

**Slack Cooperage** — Cooperage used as containers for dry, semidry or solid products. The staves are usually not closely fitted and are held together with beaded steel, wire, or wood hoops.

**Tight Cooperage** — Cooperage used as containers for liquids, semisolids, and heavy solids. Staves are well fitted and held tightly with cooperage-grade steel hoops.

**Crossband.** To place the grain of layers of wood at right angles in order to minimize shrinking and swelling; also, in plywood of three or more plies, a layer of veneer whose grain direction is at right angles to that of the face plies.

**Cup.** A distortion of a board in which there is a deviation flatwise from a straight line across the width of the board.

**Cut Stock.** A term of softwood stock comparable to dimension parts in hardwoods. (See **Dimension Parts**.)

**Cuttings.** In hardwoods, portions of a board having the quality required by a specific grade or for a particular use. Obtained from a board by crosscutting or ripping.

**Decay.** The decomposition of wood substance by fungi.

**Advanced** (or **Typical Decay**) — The older stage of decay in which the destruction is readily recognized because the wood has become punky, soft and spongy, stringy, ringshaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent.

**Incipient Decay** — The early stage of decay that has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It is usually accompanied by a slight discoloration or bleaching of the wood.

**Density.** As usually applied to wood of normal cellular form, density is the mass of wood substance enclosed within the boundary surfaces of a wood-plus-voids complex having unit volume. It is variously expressed as pounds per cubic foot, kilograms per cubic meter, or grams per cubic centimeter at a specified moisture content.

**Diffuse-Porous Wood.** Certain hardwoods in which the pores tend to be uniform in size and distribution throughout each annual ring or to decrease in size slightly and gradually toward the outer border of the ring.

**Dimension Parts.** A term largely superseded by the term "hardwood dimension lumber." It is hardwood stock processed to a point where the maximum waste is left at the mill, and the maximum utility is delivered to the user. It is stock of specified thickness, width, and length, or multiples thereof. According to specification it may be solid or glued up, rough or surfaced, semifabricated or completely fabricated.

**Dote.** "Dote," "doze," and "rot" are synonymous with "decay" and are any form of decay that may be evident as either a discoloration or a softening of the wood.

**Dry Rot.** A term loosely applied to any dry, crumbly rot but especially to that which, when in an advanced stage, permits the wood to be crushed easily to a dry powder. The term is actually a misnomer for any decay, since all fungi require considerable moisture for growth.

**Earlywood.** The portion of the annual growth ring that is formed during the early part of the growing season. It is usually less dense and weaker mechanically than latewood.

**Edge Grain.** (See **Grain**.)

**Equilibrium Moisture Content.** The moisture content at which wood neither gains nor loses moisture when surrounded by air at a given relative humidity and temperature.

**Finish (Finishing).** Wood products such as doors, stairs, and other fine work required to complete a building, especially the interior. Also, coatings of paint, varnish, lacquer, wax, etc., applied to wood surfaces to protect and enhance their durability or appearance.

**Flitch.** A portion of a log sawn on two or more faces — commonly on opposite faces leaving two waney edges. When intended for resawing into lumber, it is resawn parallel to its original wide faces. Or, it may be sliced or sawn into veneer, in which case the resulting sheets of veneer laid together in the sequence of cutting are called a flitch. The term is loosely used. (See **Cant**).

**Grain.** The direction, size, arrangement, appearance, or quality of the fibers in wood or lumber. To have a specific meaning the term must be qualified.

**Close-Grained Wood** — Wood with narrow, inconspicuous annual rings. The term is sometimes used to designate wood having small and closely spaced pores, but in this sense the term "fine textured" is more often used.

**Coarse-Grained Wood** — Wood with wide conspicuous annual rings in which there is considerable difference between springwood and summerwood. The term is sometimes used to designate wood with large pores, such as oak, ash, chestnut, and walnut, but in this sense the term "coarse textured" is more often used.

**Cross-Grained Wood** — Wood in which the fibers deviate from a line parallel to the sides of the piece. Cross grain may be either diagonal or spiral grain or a combination of the two.

**Curly-Grained Wood** — Wood in which the fibers are distorted so that they have a curled appearance, as in "birdseye" wood. The areas showing curly grain may vary up to several inches in diameter.

**Diagonal-Grained Wood** — Wood in which the annual rings are at an angle with the axis of a piece as a result of sawing at an angle with the bark of the tree or log. A form of cross-grain.

**Edge-Grained Lumber** — Lumber that has been sawed so that the wide surfaces extend



approximately at right angles to the annual growth rings. Lumber is considered edge grained when the rings form an angle of 45° to 90° with the wide surface of the piece.

**End-Grained Wood** — The grain as seen on a cut made at a right angle to the direction of the fibers (e.g., on a cross section of a tree).

**Fiddleback-Grained Wood** — Figure produced by a type of fine wavy grain found, for example, in species of maple; such wood being traditionally used for the backs of violins.

**Fine-Grained Wood** — (See **Grain**.)

**Flat-Grained Wood** — Lumber that has been sawed parallel to the pith and approximately tangent to the growth rings. Lumber is considered flat grained when the annual growth rings make an angle of less than 45° with the surface of the piece.

**Interlocked-Grained Wood** — Grain in which the fibers put on for several years may slope in a right-handed direction, and then for a number of years the slope reverses to a left-hand direction, and later changes back to a right-handed pitch, and so on. Such wood is exceedingly difficult to split radially, though tangentially it may split fairly easily.

**Open-Grained Wood** — Common classification for woods with large pores, such as oak, ash, chestnut, and walnut. Also known as "coarse textured."

**Plainsawn Lumber** — Another term for flat-grained lumber.

**Quartersawn Lumber** — Another term for edge-grained lumber.

**Side-Grained Wood** — Another term for flat-grained lumber.

**Slash-Grained Wood** — Another term for flat-grained lumber.

**Spiral-Grained Wood** — Wood in which the fibers take a spiral course about the trunk of a tree instead of the normal vertical course. The spiral may extend in a right-handed or left-handed direction around the tree trunk. Spiral grain is a form of cross grain.

**Straight-Grained Wood** — Wood in which the fibers run parallel to the axis of a piece.

**Vertical-Grained Lumber** — Another term for edge-grained lumber.

**Wavy-Grained Wood** — Wood in which the fibers collectively take the form of waves or undulations.

**Green.** Freshly sawn or undried wood. Wood that has become completely wet after immersion in water would not be considered green, but may be said to be in the "green condition."

**Growth Ring.** (See **Annual Growth Ring**.)

**Gum.** A comprehensive term for nonvolatile viscous plant exudates, which either dissolve or swell up in contact with water. Many substances referred to as gums such as pine and spruce gum are actually oleoresins.

**Hardwoods.** Generally one of the botanical groups of trees that have broad leaves in contrast to the conifers or softwoods. The term has no reference to the actual hardness of the wood.

**Heart Rot.** Any rot characteristically confined to the heartwood. It generally originates in the living tree.

**Heartwood.** The wood extending from the pith to the sapwood, the cells of which no longer participate in the life processes of the tree. Heartwood may contain phenolic compounds, gums, resins, and other materials that usually make it darker and more decay resistant than sapwood.

**Kiln.** A chamber having controlled air-flow, temperature, and relative humidity for drying lumber, veneer, and other wood products.

**Compartment Kiln** — A kiln in which the total charge of lumber is dried as a single unit. It is designed so that, at any given time, the temperature and relative humidity are essentially uniform throughout the kiln. The temperature is increased as drying progresses, and the relative humidity is adjusted to the needs of the lumber.

**Progressive Kiln** — A kiln in which the total charge of lumber is not dried as a single unit but as several units, such as kiln truckloads, that move progressively through the kiln. The kiln is designed so that the temperature is lower and the relative humidity higher at the end where the lumber enters than at the discharge end.

**Knot.** That portion of a branch or limb that has been surrounded by subsequent growth of the stem. The shape of the knot as it appears on a cut surface depends on the angle of the cut relative to the long axis of the knot.

**Encased Knot** — A knot whose rings of annual growth are not intergrown with those of the surrounding wood.

**Intergrown Knot** — A knot whose rings of annual growth are completely intergrown with those of the surrounding wood.

**Loose Knot** — A knot that is not held firmly in place by growth or position and that cannot be relied upon to remain in place.

**Pin Knot** — A knot that is not more than ½ inch in diameter.

**Sound Knot** — A knot that is solid across its face, at least as hard as the surrounding wood, and shows no indication of decay.

**Spike Knot** — A knot cut approximately parallel to its long axis so that the exposed section is definitely elongated.

**Lignin.** The second most abundant constituent of wood, located principally in the secondary wall and the middle lamella, which is the thin cementing layer between wood cells. Chemically it is an irregular polymer of substituted propylphenol groups, and thus no simple chemical formula can be written for it.

**Lumber.** The product of the saw and planing mill not further manufactured than by sawing, resawing, passing lengthwise through a standard planing machine, crosscutting to length, and matching.

**Boards** — Lumber that is nominally less than 2 inches thick and 2 or more inches wide. Boards less than 6 inches wide are sometimes called strips.

**Dimension** — Lumber with a nominal thickness of from 2 up to but not including 5 inches and a nominal width of 2 inches or more.

**Dressed Size** — The dimensions of lumber after being surfaced with a planing machine. The dressed size is usually  $\frac{1}{2}$  to  $\frac{3}{4}$  inch less than the nominal or rough size. A 2- by 4-inch stud, for example actually measures about  $1\frac{1}{2}$  by  $3\frac{1}{2}$  inches.

**Factory and Shop Lumber** — Lumber intended to be cut up for use in further manufacture. It is graded on the basis of the percentage of the area that will produce a limited number of cuttings of a specified minimum size and quality.

**Matched Lumber** — Lumber that is edge dressed and shaped to make a close tongue-and-grooved joint at the edges or ends when laid edge to edge or end to end.

**Nominal Size** — As applied to timber or lumber, the size by which it is known and sold in the market; often differs from the actual size.

**Patterned Lumber** — Lumber that is shaped to a pattern or to a molded form in addition to being dressed, matched, or shiplapped, or any combination of these workings.

**Rough Lumber** — Lumber that has not been dressed (surfaced) but which has been sawn, edged, and trimmed.

**Shiplapped Lumber** — Lumber that is edge dressed to make a lapped joint.

**Shipping-Dry Lumber** — Lumber that is partially dried to prevent stain and mold in transit.

**Side Lumber** — A board from the outer portion of the log — ordinarily one produced when squaring off a log for a tie or timber.

**Structural Lumber** — Lumber that is intended for use where allowable properties are required. The grading of structural lumber is based on the strength or stiffness of the piece as related to anticipated uses.

**Surfaced Lumber** — Lumber that is dressed by running it through a planer.

**Timbers** — Lumber that is nominally 5 or more inches in least dimensions. Timbers may be used as beams, stringers, posts, caps, sills, girders, purlins, etc.

**Yard Lumber** — A little-used term for lumber of all sizes and patterns that is intended for general building purposes having no design property requirements.

**Manufacturing Defects.** Includes all defects or blemishes that are produced in manufacturing, such as chipped grain, loosened grain, raised grain, torn grain, skips in dressing, hit and miss (series of surfaced areas with skips between them), variation in sawing, miscut lumber, machine burn, machine gouge, mismatching, and insufficient tongue and groove.

**Millwork.** Planed and patterned lumber for finish work in buildings, including items such as sash, doors, cornices, panelwork, and other items of interior and exterior trim. Does not include flooring, ceiling, or siding.

**Mineral Streak.** An olive to greenish-black or brown discoloration of undetermined cause in hardwoods.

**Modified Wood.** Wood processed by chemical treatment, compression, or other means (with or without heat) to impart properties quite different from those of the original wood.

**Moisture Content.** The amount of water contained in the wood, usually expressed as a percentage of the weight of the oven-dry wood.

**Moulding.** A wood strip having a curved or projecting surface, used for decorative purposes.

**Old Growth.** Timber in or from a mature, established forest. When the trees have grown during most if not all of their individual lives in active competition with their companions for sunlight and moisture, this timber is usually straight and relatively free of knots.

**Pallet.** A low wood or metal platform on which material can be stacked to facilitate mechanical handling, moving, and storage.



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**Peck.** Pockets or areas of disintegrated wood caused by advanced stages of localized decay in the living tree. It is usually associated with cypress and incense-cedar. There is no further development of peck once the lumber is seasoned.

**Pitch Pocket.** An opening extending parallel to the annual growth rings and containing, or that has contained, pitch, either solid or liquid.

**Pitch Streaks.** A well-defined accumulation of pitch in a more or less regular streak in the wood of certain conifers.

**Pith.** The small, soft core occurring near the center of a tree trunk, branch, twig, or log.

**Pith Fleck.** A narrow streak, resembling pith on the surface of a piece; usually brownish, up to several inches in length; results from burrowing of larvae in the growing tissues of the tree.

**Plank.** A broad board, usually more than 1 inch thick, laid with its wide dimension horizontal and used as a bearing surface.

**Plywood.** A glued wood panel made up of relatively thin layers of veneer with the grain of adjacent layers at right angles, or of veneer in combination with a core of lumber or of reconstituted wood. The usual constructions have an odd number of layers.

**Radial.** Coincident with a radius from the axis of the tree or log to the circumference. A radial section is a lengthwise section in a plane that passes through the centerline of the tree trunk.

**Rays, Wood.** Strips of cells extending radially within a tree and varying in height from a few cells in some species to 4 or more inches in oak. The rays serve primarily to store food and transport it horizontally in the tree. On quartersawed oak, the rays form a conspicuous figure, sometimes referred to as flecks.

**Reaction Wood.** Wood with more or less distinctive anatomical characters, formed typically in parts of leaning and crooked stems and in branches. In hardwoods this consists of tension wood and in softwoods of compression wood.

**Sapwood.** The wood of pale color near the outside of the log. Under most conditions the sapwood is more susceptible to decay than heartwood.

**Saw Kerf.** (1) Grooves or notches made in cutting with a saw; (2) that portion of a log, timber, or other piece of wood removed by the saw in parting the material into two pieces.

**Seasoning.** Removing moisture from green wood to improve its serviceability.

**Air-Dried** — Dried by exposure to air in a yard or shed, without artificial heat.

**Kiln-Dried** — Dried in a kiln with the use of artificial heat.

**Second Growth.** Timber that has grown after the removal, whether by cutting, fire, wind, or other agency, of all or a large part of the previous stand.

**Shake.** A separation along the grain, the greater part of which occurs between the rings of annual growth. Usually considered to have occurred in the standing tree or during felling.

**Shaving.** A small wood particle of indefinite dimensions developed incidental to certain woodworking operations involving rotary cutterheads usually turning in the direction of the grain. This cutting action produces a thin chip of varying thickness, usually feathered along at least one edge and thick at another and generally curled.

**Shear.** A condition of stress or strain where parallel planes slide relative to one another.

**Soft Rot.** A special type of decay developing under very wet conditions (as in cooling towers and boat timbers) in the outer wood layers, caused by cellulose-destroying microfungi that attack the secondary cell walls and not the intercellular layer.

**Softwoods.** Generally, one of the botanical groups of trees that in most cases have needlelike or scalelike leaves, the conifers, also the wood produced by such trees. The term has no reference to the actual hardness of the wood.

**Specific Gravity.** As applied to wood, the ratio of the oven-dry weight of a sample to the weight of a volume of water equal to the volume of the sample at a specified moisture content (green, air-dry, or oven-dry).

**Stain.** A discoloration in wood that may be caused by such diverse agencies as micro-organisms, metal, or chemicals. The term also applies to materials used to impart color to wood.

**Blue Stain** — A bluish or grayish discoloration of the sapwood caused by the growth of certain dark-colored fungi on the surface and in the interior of the wood; made possible by the same conditions that favor the growth of other fungi.

**Brown Stain** — A rich brown to deep chocolate-brown discoloration of the sapwood of some pines caused by a fungus that acts much like the blue-stain fungi.

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**Chemical Brown Stain** — A chemical discoloration of wood, which sometimes occurs during the air drying or kiln drying of several species, apparently caused by the concentration and modification of extractives.

**Sap Stain** — (See **Stain**.)

**Sticker Stain** — A brown or blue stain that develops in seasoned lumber where it has been in contact with the stickers.

**Stickers.** Strips or boards used to separate the layers of lumber in a pile and thus improve air circulation.

**Stringer.** A timber or other support for cross members in floors or ceilings. In stairs, the support on which the stair treads rest.

**Structural Timbers.** Pieces of wood of relatively large size, the strength or stiffness of which is the controlling element in their selection and use. Examples of structural timbers are trestle timbers (stringers, caps, posts, sills, bracing, bridge ties, guardrails); car timbers (car framing, including upper framing, car sills); framing for building (posts, sills, girders,); ship timber (ship timbers, ship decking); and crossarms for poles.

**Stud.** One of a series of slender wood structural members used as supporting elements in walls and partitions.

**Tension Wood.** Abnormal wood found in leaning trees of some hardwood species and characterized by the presence of gelatinous fibers and excessive longitudinal shrinkage. Tension wood fibers hold together tenaciously, so that sawed surfaces usually have projecting fibers, and planed surfaces often are torn or have raised grain. Tension wood may cause warping.

**Texture.** A term often used interchangeably with grain. Sometimes used to combine the concepts of density and degree of contrast between earlywood and latewood. In this book, texture refers to the finer structure of the wood (see **Grain**) rather than the annual rings.

**Twist.** A distortion caused by the turning or winding of the edges of a board so that the four corners of any face are no longer in the same plane.

**Wane.** Bark or lack of wood from any cause on edge or corner of a piece except for eased edges.

**Warp.** Any variation from a true or plane surface. Warp includes bow, crook, cup, and twist, or any combination thereof.

**Weathering.** The mechanical or chemical disintegration and discoloration of the surface of wood caused by exposure to light, the action of dust and sand carried by winds, and the alternate shrinking and swelling of the surface fibers with the continual variation in moisture content brought by changes in the weather. Weathering does not include decay.