

# A GUIDE TO AMERICAN SOFTWOOD SPECIES



### SUSTAINABILITY-QUALITY-VERSATILITY

AmericanSoftwoods.com



# INTRODUCTION

Softwoods have been exported from the United States for over 400 years. Today, America is recognized worldwide as a sustainable source of top quality timber. This popularity is based on:

- Standardization of sizes and stress ratings
- Quality control through the enforcement of a single unified grading system
- Strength and durability
- Suitability for preservative and fire-retardant treatments
- Construction standardization.

The simple cell structure of softwoods' long, uniformly packed fibres gives them a high strength-to-weight ratio, making them flexible and capable of bearing heavy loads. American softwoods have the strength to sustain longer spans for trusses and joists, as well as the clear, fine-grained timber that is in demand for joinery applications, such as panelling, door frames, windows, flooring and furniture. The various species of softwoods from Southern and Western America provide a wide range of choices.

This guide presents details of the botanical classification, properties and uses of the most commercially important American softwood species. Because of their versatility, most species can be used for a wide range of applications.

American softwood timber is marketed by members of the Softwood Export Council (SEC) and the Southern Forest Products Association (SFPA), known jointly as American Softwoods.



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# A SUSTAINABLE RESOURCE

America's forests currently produce over 80 million cubic metres of sawn timber a year, making them the largest producers in the world. About 10 per cent of this timber is exported overseas.

Modern forest management ensures not only that felled trees are replaced, but that every year more wood is grown in US forests than is harvested. As a result, the US has more trees today than 70 years ago. 1.6 billion seedlings are planted in the US every year, the equivalent of 4.4 million trees every single day of the year.



# THE LOW CARBON CHOICE

### Help tackle climate change – use more wood

No other material can match wood's unique benefits. It is light, strong, easy to work, affordable and good-looking. But, as sustainability and carbon reduction become increasingly important to all building activity, wood's compelling environmental benefits are helping to make it today's building material of choice:

- It is the world's only naturally renewable mainstream building material
- It is the only building material to provide third party verification
  of sustainability, through international forest certification programmes
  such as the Forest Stewardship Council (FSC), the Programme for
  the Endorsement of Forest Certification (PEFC), Sustainable Forestry
  Initiative (SFI) and schemes such as the American Tree Farm System
- It is reusable, recyclable, can be used as biomass fuel and is biodegradable
- It has better insulation properties than other building materials
- Trees require less energy (and therefore CO<sub>2</sub> emissions) to harvest and convert into finished products than any other construction material
- Growing trees remove CO<sub>2</sub> from the atmosphere and give off life-sustaining oxygen
- Wood products store CO<sub>2</sub>, keeping it out of the atmosphere while stimulating the expansion of managed forests, which absorb yet more CO<sub>2</sub>.

# SOUTHERN YELLOW PINE

Pinus palustris, Pinus elliottii, Pinus echinata and Pinus taeda



### **General description**

The four main species of Southern Yellow Pine are Longleaf (*Pinus palustris*), Slash (*Pinus elliottii*), Shortleaf (*Pinus echinata*) and Loblolly pine (*Pinus taeda*). The wood has a distinctive colour and grain, its sapwood ranging from white to yellowish and heartwood from yellow to reddish-brown. It combines looks, strength, and extreme ease of treatment with the highest nail-holding ability.

### Main uses

Most is used structurally, for floor and roof trusses, joists, rafters and carcassing. Ease of treatment makes it particularly good for decking and outdoor use. Character and impact resistance make it suitable for flooring, panelling and joinery.

### Working properties

★★★☆☆
****
*****
*****

### Distribution and availability

Grown on 78 million hectares of forest land in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North and South Carolina, Oklahoma, Tennessee, Texas and Virginia. Widely available.

### **Physical & mechanical properties**

See chart on pages 18/19. Medium texture. Weight ranges from 537 to 626 kg per cubic metre. High density gives it natural strength, weight, and impact and wearing resistance. It has a higher specific gravity than European Redwood and, although easy to work with, stands up well to rough treatment.

### Durability

Slightly durable. Easy to treat.

### EASTERN WHITE PINE Pinus strobus



### **General description**

A creamy straw-colour that will darken with age to a deep rich tan. Available in a wide range of grades and sizes.

### Main uses

A mainstay of quality construction and fine woodworking, Eastern white pine is a favourite for cladding, panelling, mouldings and furniture.

### Distribution and availability

Eastern white pine forests cover much of Northeast America. Widely available.

### Working properties

★★★★☆
<b>★★★★</b> ☆
******
*****

### **Physical & mechanical properties**

See chart on pages 18/19. Medium texture. Weight ranges from 390-415 kg/cubic metre. With its fine grain and uniform texture, it has good manufacturing qualities and holds finishes well.

### Durability

Slightly durable. Easy to treat.

# WESTERN PINES

Pinus spp.



### **General description**

Often referred to as the White pines, this is a commercially important group, known for its resinous odour and light colour.

### Main uses

Ponderosa pine (*Pinus ponderosa*)<sup>1</sup>, Sugar pine (*Pinus lambertiana*)<sup>2</sup> and Idaho White pine (*Pinus monticola*)<sup>3</sup> are valued primarily for their appearance. Ponderosa pine is suitable for any application that requires a light to moderately strong, splinter-free, stable wood, such as jointed drawers, windows, shutters and stairs. Sugar pine is prized for precision woodworking: patterns, piano keys, doors and cabinetwork. Idaho White pine is ideal for architectural mouldings and turned items.

### Distribution and availability

Ponderosa pine has a range that extends from Canada to Mexico and from the Pacific Ocean to South Dakota and is widely available.



Working properties

Machining	★★★★☆
Splitting resistance	****
Screw/nail-holding	******
Gluing	<b>★★★</b> ☆

Sugar pine grows mainly in the Sierra Nevada mountains of central and northern California, with good availability. Idaho White pine grows intermixed with other species from Colorado through Wyoming, Idaho, Montana and eastern Washington. Supply is limited.

### **Physical & mechanical properties**

See chart on pages 18/19. Ponderosa pine is light and soft-textured, with a uniform, close, straight grain that is delicately figured after dressing. It seasons well, with a minimum of warping and cupping. Sugar pine has low volumetric shrinkage and a uniform texture. Idaho White pine has exceptional workability with and across the grain.

### Durability

Slightly durable. Easy to treat.

**HEM-FIR** *Tsuga heterophylla and Abies spp.* 



### **General description**

A species combination of the five true firs: California Red fir (*Abies magnifica*)<sup>1</sup>, Grand fir (*Abies grandis*), White fir (*Abies concolor*)<sup>2</sup>, Noble fir (*Abies procera*)<sup>3</sup> and Pacific Silver fir (*Abies amabilis*)<sup>4</sup> with Western hemlock (*Tsuga heterophylla*)<sup>5</sup>. Fine-grained and with interchangeable structural performance, these trees are marketed together as an elegant softwood, classified as a white wood, combining beauty and strength. A very light colour, from creamy white spring wood to a light straw-brown (hemlock) or reddish-brown (firs).

### Main uses

Joinery that requires precision machining, a pale colour and excellent gluing, such as mouldings, exposed ceilings, doors, louvres, windows, furniture, flooring and laminated structural and non-structural products. Structural products, such as framing and engineered systems.

# 3\* 4

### Working properties

• • • •	
Machining	*******
Splitting resistance	★★★★☆
Screw/nail-holding	******
Gluing	<b>★★★★</b> ☆

### **Distribution and availability**

Second only to Douglas fir in abundance, Hem-fir accounts for 22 per cent of solid sawn production from the Western Woods region. The species grow in stands along the Pacific Coast from Northern California to Alaska and inland along the US/Canadian border as far as Montana. Readily available.

### **Physical & mechanical properties**

See chart on pages 18/19. Straight grain and fine texture. Sands to a silky smoothness with virtually no tendency to split. Weight ranges from 537 to 626 kg per cubic metre. Knotty appearance grades for joinery; lower knotty grades for general construction. Good strength and stiffness. Good insulating properties. Holds its original colour well.

### **Durability**

Slightly durable. Moderately easy to treat.

### WESTERN HEMLOCK Tsuga heterophylla



### **General description**

Among the harder, stronger Western softwoods, it is marketed and sold separately as well as in the Hem-fir species combination. Springwood is whitish to light yellow-brown; summerwood frequently has a purplish or reddish-brown tinge; heartwood not distinct. Small black streaks often appear in the wood.

### Main uses

It is used for framing and architectural members and is a prime species for mouldings, millwork and panelling.

### Working properties

<b>★★★</b> ☆☆
****
★★★☆☆
★★★☆☆

### Distribution and availability

Grows best in the Pacific Northwest between sea level and 1850 metres. Readily available.

### **Physical & mechanical properties**

See chart on pages 18/19. Weight 465 kg per cubic metre. Straight grain and fine texture.

### **Durability**

Slightly durable. Moderately easy to treat.

### **DOUGLAS FIR** *Pseudotsuga menziesii*



### **General description**

Straight-grained and moderately heavy, with limited resin, this is one of the most attractive and strongest of the Western softwood species. The wood has a slight rosy cast; the sapwood generally a light straw colour and the heartwood a deep russet brown.

### Main uses

Its appearance is prized for joinery, panelling, cabinets, flooring, windows and cladding. Its strength, straightness and ease of fabrication make it the perfect highperformance timber for structural uses, such as metal plate-connected trusses, framing, bridges and large heavy members.

### Distribution and availability

One of the tallest on the continent, this species accounts for a fifth of North America's total softwood reserves and is grown on 14 million hectares of forest in the Western Woods region. Readily available.

### Working properties

<b>★★★</b> ☆☆
*******
★★★★☆
******

### **Physical & mechanical properties**

See chart on pages 18/19. Medium texture, with a weight of 540 kg per cubic metre, and a high density, specific gravity and strengthto-weight ratio. Very stiff, with high strength values in bending, tension, horizontal sheer and compression. High shrinkage when seasoned from a green state, but minimal shrinkage and swelling once seasoned.

### Durability

Moderately durable. Difficult to treat incising is recommended for maximum penetration of preservative.

# SPRUCE-PINE-FIR SOUTH (SPFS)

This species combination, classed as moderately strong, is cross-continental in origin. Because of similar design values, the combination includes Engelmann and Sitka spruces and Lodgepole pine from the West, along with Balsam fir, Jack pine, Red pine and several species of spruce from the US Northeast. Spruce-Pine-Fir (south) design values make it appropriate for general framing applications. In the higher, structural light framing grades, dimension products are appropriate for light trusses and other engineered applications.

# SITKA SPRUCE

Picea sitchensis



### **General description**

The creamy white to light yellow sapwood blends gradually into its pinkish-yellow to light-brown heartwood. It is marketed and sold separately or in the Spruce-Pine-Fir (south) species combination.

### Main uses

High quality pianos, stringed instruments, joinery and boats. It is also used for light framing in structural applications, ladder rails, scaffolding and other uses where its high strength-to-weight ratio is important.

### Working properties

0	
Machining	<b>★★★</b> ☆☆
Splitting resistance	****
Screw/nail-holding	*****
Gluing	★★★★☆

### Distribution and availability

Its natural home is a narrow belt of the Pacific Northwest coast of North America, from Alaska, through Washington and Oregon to Northern California. Readily available.

### Physical & mechanical properties

See chart on pages 18/19. Weighs 349 kg per cubic metre. A clear, straight-grained wood, classed moderate in many of its properties, including weight and hardness. It has the highest strength-to-weight ratio of any species.

### Durability

Not durable. Difficult to treat.

### **ENGELMANN SPRUCE** *Picea engelmannii*



### **General description**

Among the lightest of the commercially important softwoods, although strong in relation to weight. It is nearly white, with a reddish tinge, and odourless. Structural framing grades are marketed and sold in the Spruce-Pine-Fir (south) species combination; appearance grades are often marketed in the ES-LP (Engelmann spruce/ Lodgepole pine) combination.

### Main uses

Framing, wall panelling and some joinery.

### Working properties

Machining
Splitting resistance
Screw/nail-holding
Gluing

### Distribution and availability

A major component of the high-elevation Rocky Mountain forests, growing in the Rocky Mountains of Southwestern Alberta, south through the high mountains of Eastern Washington and Oregon, Idaho, and Western Montana to Western and Central Wyoming, and in the high mountains of Southern Wyoming, Colorado, Utah, Eastern Nevada, New Mexico and Northern Arizona. Readily available.

### **Physical & mechanical properties**

See chart on pages 18/19. Medium to fine textured and straight grained, with good workability. Weighing 368 kg per cubic metre, it is low in strength as a beam or post, soft, low in shock resistance, and has moderately small shrinkage. Relatively small, uniformly distributed knots.

### Durability

Not durable. Difficult to treat.

### WESTERN LARCH Larix occidentalis



### **General description**

Distinct among commercial softwoods for its fine, uniform, straight grain, Western larch is one of the harder, stronger and heavier softwoods. Heartwood is russet or reddish brown; sapwood is straw brown. Usually marketed and sold as Douglas fir-Larch.

### Main uses

Used principally as structural framing timber; when rotary cut, for veneer and plywood sheathing.

### Distribution and availability

Native to the high mountains of the upper Columbia River Basin in Southeastern British Columbia, Northwestern Montana, Northern and Central Idaho, Washington and Northern and Northeastern Oregon.

### Working properties

Machining	******
Splitting resistance	******
Screw/nail-holding	★★★★☆
Gluing	******

### **Physical & mechanical properties**

See chart on pages 18/19. Tough fibred and somewhat oily in appearance, the wood weighs 577 kg per cubic metre and is stiff, moderately strong and hard, with moderately large shrinkage. The wood is usually straight grained, splits easily, and is subject to ring shake. Knots are common but generally small and tight.

### Durability

Slightly durable. Moderately easy to treat.

### WESTERN RED CEDAR Thuja plicata



### **General description**

A slow-growing, long-lived tree, whose aromatic wood is highly decay-resistant. The sapwood, usually less than 2.5 centimetres wide, is almost pure white, while the heartwood varies from a dark reddish brown to light yellow.

### Main uses

Cladding, shingles and other exterior applications, such as greenhouses. Boatbuilding and marine structures. Interior panelling, window sashes and built-in furniture.

### Working properties

Machining	★★★★☆
Splitting resistance	★★★★☆
Screw/nail-holding	*****
Gluing	<b>★★★★</b> ☆

### Distribution and availability

Found in the Pacific Northwest and inland to the Rocky Mountains in stands totalling 48.7 million cubic metres. Exceptional coastal area trees reach a height of 60 metres, a diameter of 4.9 metres and an age of 1,000 years or more. Readily available.

### **Physical & mechanical properties**

See chart on pages 18/19. A coarse-textured softwood, weighing 376 kg per cubic metre, with a close, uniform, straight grain and an extreme resistance to decay. Dimensionally stable, it takes paint, stains or varnishes easily. Untreated, it weathers to a silvery-grey.

### **Durability** Durable. Difficult to treat with preservative.

# **OTHER SPECIES**



### California redwood

Sequoia sempervirens

Found exclusively in Northern California, this coastal redwood is grown commercially in natural stands. The sapwood is creamcoloured and the durable heartwood a reddish brown. Dimensionally stable with a refined texture and grain, redwood is world-renowned for its superb performance in exposed conditions: outdoor decks, garden structures, cladding, fascia, fences, benches. It weighs from 394-448 kg per cubic metre and is marketed and sold separately.

# Working properties

Machining ★★★★☆ Splitting resistance ★★★★☆ Screw/nail-holding ★★☆☆☆ Gluing ★★★★☆



### Bald cypress Taxodium distichum

Most cypress trees are native to the South. They are found primarily in wet, swampy areas. Cypress trees are conifers, but unlike most American softwoods, they are deciduous, shedding foliage in autumn like hardwoods. Although cypress is a softwood, it grows alongside hardwoods and traditionally has been grouped and manufactured with hardwoods. The oils in cypress' heartwood make it one of the most durable woods when exposed to moisture conditions causing decay.

# Working properties

Machining ★★★☆☆ Splitting resistance ★★★★☆ Screw/nail-holding ★★★★☆ Gluing ★★★☆☆



### Alaskan yellow cedar Chamaecyparis nootkatensis

The lightest in colour of the naturally durable American softwoods. Fine, uniform texture and straight grain; silvers on exposure. Strongly aromatic, moderately strong and hard. Used where weather-resistance, stability and workability are needed: park benches, exterior cabinetwork, stage construction, foundry patterns, marine and landscape installations. It weighs 497 kg per cubic metre and is marketed and sold separately.

### Port Orford cedar

Chamaecyparis lawsoniana

Found in a small area of Southern Oregon and Northern California. Port Orford cedar is finely textured with a pungent, ginger-like odour. Its heartwood is light yellow to pale brown, the sapwood is thin and hard to distinguish. Easily worked and polished, it is often substituted in Japan for Hinoki when appearance is important. Also used in woodenware, novelties and toys. It weighs 465 kg per cubic metre and is marketed and sold separately; limited availability.



### Incense cedar

Libocedrus decurrens

Fine and uniformly textured with a distinctly spicy odour. Its sapwood is white or creamcoloured, while the extremely durable heartwood is light brown, often tinged with red. A highly workable wood, it machines and weathers well. It is used outdoors as landscape material, decking and fencing, as well as for panelling, louvres and pencils. It weighs 384 kg per cubic metre and is marketed and sold separately or in the Western cedars combination.

### Working properties

### Machining

\*\*\*\*\* Splitting resistance \*\*\*\*\* Screw/nail-holding \*\*\*\*\*\* Gluing \*\*\*\*\*\*

### Working properties

Machining \*\*\*\*\* Splitting resistance \*\*\*\*\* Screw/nail-holding \*\*\*\*\*\* Gluing \*\*\*\*\*\*

### Working properties

Machining \*\*\*\*\* Splitting resistance \*\*\*\*\* Screw/nail-holding \*\*\*\*\*\* Gluing \*\*\*\*\*\*



# **COMPARATIVE TABLE**

gravity'         rupture (IPa)         elaticity (Mpa)'         parallel to grain (IPa)           Southern Yellow Pine (US)	Species	Botanical name	Specific	Modulus of	Modulus of	Compressive strength
Southern Yellow Pine (US)         Image palastris         0.59         112,000         13,700         58,400           Stash         Pmus palastris         0.59         112,000         13,700         56,100           Shoh         Pmus secharata         0.51         90,000         12,100         50,100           Lobiolly         Pmus starba         0.51         90,000         12,300         92,000           Eastern white pine (US)         Pmus starba         0.35         57,000         8,000         33,100           Penderosa         Pmus monticola         0.36         57,000         8,000         34,700           Scots Pine (U)*         Pmus monticola         0.35         67,000         10,000         44,700           Scots Pine (U)*         Pmus anbaca         80,700         10,000         45,000           Radita pine         Pmus anbaca         80,700         10,200         41,900           Caribbara pine         Pmus anbaca         115,100         14,000         59,000           Caribbara pine         Abes grandis         0.37         61,4000         10,800         36,500           Whet fin         Abes grandis         0.37         61,4000         10,800         36,500           <			gravity <sup>3</sup>	rupture (kPa)	elasticity (Mpa) <sup>4</sup>	parallel to grain (kPa)
Southern Yellow Prec (US)         Immu pallistris         0.59         110,000         13,700         58,400           Slash         Prinus ellicitii         0.59         112,000         13,700         56,100           Shortleaf         Prinus echimata         0.51         90,000         12,100         50,100           Lablebily         Prinus stockus         0.55         59,000         8,200         33,100           Eatern white pine (US)         Prinus stockus         0.55         59,000         8,200         3,600           Sagar         Prinus stockus         0.56         6,000         8,200         3,600           Sagar         Prinus subsettris         0.43         8,3000         10,000         4,700           Scatch Pine (U)*         Prinus sylvestris         0.43         8,3000         10,000         4,900           Radita pine         Prinus caribasa         80,700         10,200         4,900         15,400         59,000           Caribbrain pine         Prinus caribasa         0.38         7,400         10,300         37,600           Caribbrain pine         Prinus caribasa         0.37         64,000         10,800         35,500           Whene fin         Ables magnifica         0.						
Longleaf         Prus palustris         0.59         100,000         13,700         58,460           Slash         Prus elinatia         0.51         90,000         12,100         50,100           Lobeloly         Prus echinata         0.51         90,000         12,100         50,100           Lobeloly         Prus strobus         0.35         59,000         8,500         33,100           Western pine (US)         Prus ponderosa         0.40         65,000         8,900         36,700           Sugar         Prus Isambertiana         0.36         67,000         8,200         30,800           Idaho White         Prus monticola         0.35         67,000         8,200         30,800           Scots Pine (EU)*         Prus adata         80,700         10,200         41,900           Carlobar pine         Prus adata         81,100         15,400         59,000           Western hemick         Taga heterophylla         0.45         78,000         11,300         49,000           Callomia Red fir         Abies rangenifica         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         74,000         10,300         37,200	Southern Yellow Pine (US)					
Slam         Phus elliotti         0.59         112.000         13,700         56,100           Shortleaf         Phus sechanta         0.51         90,000         12,100         50,100           Eastern white pine (US)         Phus stocbus         0.35         59,000         8,200         13,200           Wettern pines (US)         Phus stocbus         0.35         57,000         8,200         30,800           Idaho White         Phus montocla         0.35         67,000         10,100         34,700           Scots Pine (EU)*         Phus stockas         0.40         65,000         8,900         36,700           Radiata pine         Phus adata         0.35         67,000         10,100         34,700           Caribbean pine         Phus catabaa         0.43         83,000         10,300         45,000           Calfornia Red fir         Abies magnifica         0.38         72,400         10,300         37,600           Calfornia Red fir         Abies magnifica         0.37         61,400         10,800         36,500           White fir         Abies magnifica         0.37         74,000         10,300         40,000           Douglas fir (US)         Pseudotsuga merziesii         0.44 <td< td=""><td>Longleaf</td><td>Pinus palustris</td><td>0.59</td><td>100,000</td><td>13,700</td><td>58,400</td></td<>	Longleaf	Pinus palustris	0.59	100,000	13,700	58,400
Shortleaf         Privis echinata         0.51         90,000         12,100         50,100           Lobiolity         Privis strobus         0.35         59,000         8,500         33,100           Western pines (US)         Privis strobus         0.35         59,000         8,200         36,700           Sagar         Privis simperitana         0.36         57,000         8,200         30,800           Idaho Vihite         Privis simperitana         0.36         57,000         8,200         30,800           Radiata pine         Privis simperitana         0.36         67,000         10,100         34,700           Caribbearp pine         Privis sandbaea         115,100         15,400         59,000         10,200         41,900           California Red fin         Abies magnifica         0.38         72,400         10,300         37,600         36,500           White fin         Abies grandis         0.37         61,100         10,800         36,500         42,100         42,100         42,100         42,100         42,100         42,100         42,100         43,300         10,300         37,500         50,000         10,300         43,00         50,000         10,300         52,000         10,300	Slash	Pinus elliottii	0.59	112,000	13,700	56,100
Lobioly         Pnus taeda         0.51         88,000         12,300         49,200           Eastern white pine (US)         Pnus sorobus         0.35         59,000         8,500         3,100           Western pines (US)         Pnus lamberitana         0.36         57,000         8,200         36,200           Sugar         Pnus lamberitana         0.36         57,000         8,200         36,800           Idaho White         Pnus monitocia         0.35         67,000         10,100         34,700           Scots Pine (EU)*         Pnus simberitana         0.43         83,000         10,000         45,000           Radiata pine         Pnus radiata         80,700         11,200         49,000         41,900           Californa Red fir         Abes grandis         0.37         61,400         10,800         36,500           White fir         Abes grandis         0.37         61,400         10,800         36,500           Noble fir         Abes sorocor         0.39         88,000         10,300         49,000           Douglas fir (US)         Pseudotuga menziesii         0.46         0.50         92,000         12,100         44,200           Douglas fir (US)         Pseudotuga menziesii         <	Shortleaf	Pinus echinata	0.51	90,000	12,100	50,100
Eastern white pine (US)         Prius strobus         0.35         59,000         8,500         33,100           Western pines (US)         Prius ponderosa         0.40         65,000         8,900         36,700           Sugar         Prius lambertiana         0.36         57,000         8,200         30,800           Idaho White         Prius lambertiana         0.36         67,000         10,100         34,700           Scots Pine (EU)*         Prius radiata         0.40         33,3000         10,000         45,000           Radiata pine         Prius radiata         80,700         10,200         41,900           Caribbear pine         Prius radiata         0.45         78,000         11,300         49,000           Caldomia Red fir         Ables grangine         0.37         61,400         0.360         36,500           White fir         Ables sprocera         0.37         74,000         11,300         49,000           Noble fir         Ables sprocera         0.39         74,000         10,300         40,000           Nolgis fir (US)         Pseudotsuga meratesii         0.44         91,000         16,800         50,000           Douglas fir (US)*         Pseudotsuga meratesii         0.54         9	Loblolly	Pinus taeda	0.51	88,000	12,300	49,200
Western pines (US)         Productosa         Productosa         Old         65,000         8,900         36,700           Sugar         Pinus lambertiana         0.36         57,000         8,200         30,800           Idaho White         Pinus monticola         0.35         67,000         10,100         34,700           Scots Pine (EU)*         Pinus avylvestris         0.43         83,000         10,200         41,900           Caribbean pine         Pinus caribaea         115,100         15,400         59,000           Hem-fir (US)         Vistern hemlock         Tsuga heterophylla         0.45         78,000         11,300         49,000           California Red fir         Abies grandis         0.37         61,400         10,300         36,600           White fir         Abies grandis         0.37         61,400         10,300         40,000           Noble fir         Abies grandis         0.44         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44         91,000         13,00         43,000           Douglas fir (US)         Pseudotsuga menziesii         0.44         91,000         14,800         50,000           Souga fir (US)	Eastern white pine (US)	Pinus strobus	0.35	59,000	8,500	33,100
Ponderosa         Pinus ponderosa         0.40         65,000         8,900         36,700           Sigar         Pinus lambertana         0.36         57,000         8,200         30,800           Idaho White         Pinus situambertana         0.35         67,000         10,100         34,700           Scots Pine (EU) <sup>4</sup> Pinus situadita         0.43         83,000         10,000         45,000           Raditat pine         Pinus radiata         80,700         10,200         41,900           Carlibbean pine         Pinus caribaea         115,100         15,400         59,000           Hem-fir (US)         Tsuga heterophylla         0.45         78,000         11,300         49,000           California Red fir         Abies grandis         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         68,000         10,300         37,600           Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fir (US)         Pseudostuga menziesii         0.44         91,000         16,800         50,000           European larch (EU) <sup>4</sup> Pseudostuga menziesii         0.54         91,000	Western pines (US)					·
Sugar         Pnus lambertiana         0.36         57,000         8,200         30,800           Idaho White         Pnus monticola         0.35         67,000         10,100         34,700           Scots Pine (FU)*         Pnus systexits         0.43         83,000         10,200         45,000           Radiata pine         Pnus carbaea         115,100         15,000         41,900           Caribbean pine         Pnus carbaea         115,100         15,000         49,000           California Red fin         Abies grandis         0.37         61,400         10,300         37,600           Grand fir         Abies grandis         0.37         61,400         10,300         40,000           Noble fir         Abies grandis         0.43         75,800         11,900         42,100           Pacific Silver fir         Abies amabilis         0.44         91,000         10,300         43,000           Douglas fir (US)         Pseudotsuga menziesii         0.44         91,000         10,500         48,300           Douglas fir (US)*         Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Sitka spruce         Preca sitchensis         0.44         91,000         16,800 <td>Ponderosa</td> <td>Pinus ponderosa</td> <td>0.40</td> <td>65,000</td> <td>8,900</td> <td>36,700</td>	Ponderosa	Pinus ponderosa	0.40	65,000	8,900	36,700
Idaho White         Pnus monticola         0.35         67,000         10,100         34,700           Scots Pine (EU)*         Pnus sylvestris         0.43         83,000         10,000         45,000           Carlibbean pine         Pnus carlbaea         80,700         12,000         41,900           Carliboran pine         Pnus carlbaea         115,100         15,400         59,000           Western hemlock         Tsuga heterophylla         0.45         78,000         10,300         37,600           California Red fir         Ables grandis         0.37         61,400         10,800         36,500           White fir         Ables concolor         0.39         68,000         10,300         40,000           Noble fir         Ables procera         0.39         78,600         11,900         42,100           Douglas fir (US)         Pseudotsuga menziesii         0.46 0.50         82-90,000         10,300-13,400         43,000-51,200           Douglas fir (US)         Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Europen larch(EU)*         Larix occidentalis         0.52         90,000         11,800         52,500           Sta spruce         Picea sitchensis         0.40	Sugar	Pinus lambertiana	0.36	57,000	8,200	30,800
Scots Pine (EU)*         Pinus sylvestris         0.43         83,000         10,000         45,000           Raditat pine         Pinus raditata         80,700         10,200         41,900           Caribbean pine         Pinus caribaea         115,100         15,400         59,000           Western hemlock         Tsuga heterophylla         0.45         78,000         11,300         49,000           California Red fir         Ables grandis         0.38         72,400         10,300         37,600           Grand fir         Ables grandis         0.37         61,400         10,800         36,500           White fir         Ables concolor         0.39         74,000         11,900         42,100           Pacific Silver fir         Ables procera         0.39         74,000         10,300.13,400         43,000-51,200           Douglas fr (US)         Pseudotsuga menziesii         0.44         91,000         16,600         50,000           Douglas fr (US)*         Pseudotsuga menziesii         0.44         91,000         16,800         50,000           Seyeen larch (US)         Larx occidentalis         0.52         90,000         11,800         52,000           European larch (US)         Larx occidentalis         0.52 <td>Idaho White</td> <td>Pinus monticola</td> <td>0.35</td> <td>67,000</td> <td>10,100</td> <td>34,700</td>	Idaho White	Pinus monticola	0.35	67,000	10,100	34,700
Radiata pine         Pinus radiata         80,700         10,200         41,900           Caribbean pine         Pinus caribaea         115,100         15,400         59,000           Hem-fir (US)         Westem hemlock         Tsuga heterophylla         0.45         78,000         11,300         49,000           Califorma Red fir         Ables grandis         0.37         61,400         10,300         37,600           Grand fir         Ables grandis         0.37         61,400         10,300         40,000           Noble fir         Ables procera         0.39         74,000         11,900         42,100           Douglas fir (US)         Pseudotsuga menziesii         0.44         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44         91,000         16,800         50,000           Douglas fir (UV)*         Pseudotsuga menziesii         0.54         91,000         16,800         50,000           European larch (EU)*         Lanx occidentalis         0.52         90,000         11,800         38,700           Sirka spruce         Picea sitchensis         0.40         70,000         10,800         38,700           European larch (EU)*         Lanx decidua	Scots Pine (EU) <sup>6</sup>	Pinus sylvestris	0.43	83,000	10,000	45,000
Caribbean pine         Pinus caribaea         115,100         15,400         59,000           Western hemlock         Tsuga heterophylla         0.45         78,000         11,300         39,000           California Red fir         Abies magnifica         0.38         72,400         10,300         37,600           Grand fir         Abies grandis         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         68,000         11,300         49,000           Noble fir         Abies procera         0.39         74,000         11,900         42,100           Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fr (US)         Pseudotsuga menziesii         0.44         91,000         10,500         48,300           Douglas fr (US)         Larix decidua         0.60         90,000         12,900         52,500           European larch(US)         Larix decidua         0.60         90,000         18,800         38,700           Engelmann spruce         Picea engelmannii         0.35         64,000         8,700         38,700           Black spruce         Picea glauca         0.36         65,	Radiata pine	Pinus radiata		80,700	10,200	41,900
Hem-fir (US)         Tsuga heterophylla         0.45         78,000         11,300         49,000           California Red fir         Abies magnifica         0.38         72,400         10,300         37,600           Grand fir         Abies grandis         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         68,000         10,300         40,000           Pacific Silver fir         Abies procera         0.39         74,000         11,700         42,100           Douglas fir (US)         Pseudotsuga menziesii         0.44-0.50         82.90,000         10,300-13,400         43,000-51,200           Douglas fir (US)         Pseudotsuga menziesii         0.54         91,000         10,500         48,300           Douglas fir (US)         Larix ocidentalis         0.52         90,000         12,900         52,500           European larch(EU)*         Larix ocidentalis         0.52         90,000         11,800         52,000           European larch(EU)*         Larix ocidentalis         0.42         74,000         11,800         38,700           Sita spruce         Picea sitchensis         0.40         70,000         10,800         38,700           Black spruce	Caribbean pine	Pinus caribaea		115,100	15,400	59,000
Western hemlock         Tauga heterophylla         0.45         78,000         11,300         49,000           Galifornia Red fir         Abies magnifica         0.38         72,400         10,300         37,600           Grand fir         Abies grandis         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         68,000         10,300         40,000           Noble fir         Abies procera         0.39         74,000         11,900         42,100           Douglas fir (US)         Pseudotsuga menziesii         0.44         97,000         10,500         48,300-51,200           Douglas fir (US)         Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Douglas fir (US)         Larx occidentalis         0.52         90,000         11,800         52,000           European larch (EU)*         Larx occidentalis         0.52         90,000         11,800         52,000           Sifua spruce         Picea marina         0.42         74,000         11,100         41,100           Red spruce         Picea marina         0.42         74,000         11,400         38,200           Mika spruce         Picea aglauca	Hem-fir (US)				· _ ·	
California Red fir         Abies magnifica         0.38         72,400         10,300         37,600           Grand fir         Abies grandis         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         68,000         10,300         40,000           Noble fir         Abies procera         0.39         74,000         11,900         42,100           Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44         91,000         16,800         50,000           Douglas fir (US)*         Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix occidentalis         0.52         90,000         12,900         52,500           European larch(EU)*         Larx decidua         0.60         90,000         11,800         52,000           SP-F South (US)         Earix occidentalis         0.52         90,000         11,800         38,700           Engelmann spruce         Picea sitchensis         0.40         74,000         11,100         41,100           Red spruce         Picea glauca	Western hemlock	Tsuga heterophylla	0.45	78,000	11,300	49,000
Grand fir         Abies grandis         0.37         61,400         10,800         36,500           White fir         Abies concolor         0.39         68,000         10,300         40,000           Noble fir         Abies procera         0.39         74,000         11,900         42,100           Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44         91,000         10,500         48,300           Douglas fir (US)         Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix decidua         0.60         90,000         11,800         52,000           StrAs spruce         Picea sitchensis         0.40         70,000         10,800         38,700           StrAs spruce         Picea rainana         0.42         74,000         11,100         41,100           Black spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea rubens         0.40         <	California Red fir	Abies magnifica	0.38	72,400	10,300	37,600
White fir         Abies concolor         0.39         68,000         10,300         40,000           Noble fir         Abies procera         0.39         74,000         11,900         42,100           Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44 - 05.0         82-90,000         10,300 - 13,400         43,000 - 51,200           Douglas fir (EU) <sup>6</sup> Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix decidua         0.52         90,000         12,800         38,700           Szeves hark (EU) <sup>6</sup> Larix decidua         0.60         90,000         10,800         38,700           Szeves hark (EU)         Larix decidua         0.40         70,000         10,800         38,700           Szeves hark (EU)         Larix decidua         0.42         74,000         11,100         41,100           Balsa spruce         Picea engelmannii         0.35         64,000         8,900         39,900           Balsam fir         Abies balsamea         0.36         65,000         9,600         35,700           Balsam fir         Ab	Grand fir	Abies grandis	0.37	61,400	10,800	36,500
Noble fir         Abies procera         0.39         74,000         11,900         42,100           Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44-0.50         82-90,000         10,300-13,400         43,000-51,200           Douglas fir (US) <sup>6</sup> Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix occidentalis         0.52         90,000         12,900         52,500           European larch (EU) <sup>6</sup> Larix occidentalis         0.52         90,000         11,800         52,000           SvefF South (US)         Erredemann spruce         Picea sitchensis         0.40         70,000         10,800         38,700           Black spruce         Picea engelmannii         0.35         64,000         8,900         30,900           Black spruce         Picea rubens         0.40         74,000         11,100         41,100           Red spruce         Picea glauca         0.36         65,000         9,600         35,700           Black spruce         Picea glauca         0.36         63,000         10,000         36,400	White fir	Abies concolor	0.39	68,000	10,300	40,000
Pacific Silver fir         Abies amabilis         0.43         75,800         12,100         44,200           Douglas fir (US)         Pseudotsuga menziesii         0.44 -0.50         82-90,000         10,300-13,400         43,000-51,200           Douglas fir (UV) <sup>5</sup> Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Douglas fir (EU) <sup>4</sup> Pseudotsuga menziesii         0.54         91,000         12,900         52,500           European larch (US)         Larix occidentalis         0.52         90,000         11,800         52,000           Seven larch (US)         Larix decidua         0.60         90,000         10,800         38,700           Stika spruce         Picea sitchensis         0.40         70,000         10,800         38,700           Baket spruce         Picea engelmanni         0.35         64,000         8,900         30,900           Black spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         37,000           Ladgepole pine	Noble fir	Abies procera	0.39	74,000	11,900	42,100
Douglas fir (US)         Pseudotsuga menziesii         0.46-0.50         82-90,000         10,300-13,400         43,000-51,200           Douglas fir (UK) <sup>5</sup> Pseudotsuga menziesii         0.44         91,000         10,500         48,300           Douglas fir (EU) <sup>6</sup> Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix occidentalis         0.52         90,000         12,900         52,500           European larch(EU) <sup>6</sup> Larix decidua         0.60         90,000         11,800         52,000           SP-F South (US)         Suita spruce         Picea sitchensis         0.40         70,000         10,800         38,700           Black spruce         Picea engelmanni         0.35         64,000         8,900         30,900           Black spruce         Picea arubens         0.40         74,000         11,400         38,200           Withe spruce         Picea glauca         0.35         63,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,300         37,600           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000	Pacific Silver fir	Abies amabilis	0.43	75,800	12,100	44,200
Douglas fr (UK) <sup>5</sup> Pseudotsuga menziesii         0.44         91,000         10,500         48,300           Douglas fr (EU) <sup>6</sup> Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix occidentalis         0.52         90,000         12,900         52,500           European larch (EU) <sup>6</sup> Larix decidua         0.60         90,000         11,800         52,000           SPF F South (US)            54,000         10,800         38,700           Sitka spruce         Picea engelmannii         0.35         64,000         8,900         30,900           Black spruce         Picea raniana         0.42         74,000         11,100         41,100           Red spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,200         37,000           Red pine         Pinus contorta         0.	Douglas fir (US)	Pseudotsuga menziesii	0.46-0.50	82-90,000	10,300-13,400	43,000-51,200
Douglas fir (EU) <sup>6</sup> Pseudotsuga menziesii         0.54         91,000         16,800         50,000           Western larch (US)         Larix occidentalis         0.52         90,000         12,900         52,500           European larch (EU) <sup>6</sup> Larix decidua         0.60         90,000         11,800         52,000           Sr-F-F South (US)	Douglas fir (UK)⁵	Pseudotsuga menziesii	0.44	91,000	10,500	48,300
Western larch (US)         Larix occidentalis         0.52         90,000         12,900         52,500           European larch (EU) <sup>6</sup> Larix decidua         0.60         90,000         11,800         52,000           S-P-F South (US)	Douglas fir (EU) <sup>6</sup>	Pseudotsuga menziesii	0.54	91,000	16,800	50,000
European larch (EU) <sup>4</sup> Larix decidua         0.60         90,000         11,800         52,000           S-P-F South (US)	Western larch (US)	Larix occidentalis	0.52	90,000	12,900	52,500
S-P-F South (US)         Picea sitchensis         0.40         70,000         10,800         38,700           Sitka spruce         Picea engelmanni         0.35         64,000         8,900         30,900           Black spruce         Picea mariana         0.42         74,000         11,100         41,100           Red spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus contorta         0.41         65,000         9,200         37,000           Uodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Witewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea abies         0.32         51,700         7,700         31,400           Mestern red         Thuja plicata         0.32         51,700         <	European larch (EU) <sup>6</sup>	Larix decidua	0.60	90,000	11,800	52,000
Sitka spruce         Picea sitchensis         0.40         70,000         10,800         38,700           Engelmann spruce         Picea engelmannii         0.35         64,000         8,900         30,900           Black spruce         Picea mariana         0.42         74,000         11,100         41,100           Red spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus contorta         0.41         65,000         9,200         37,000           Uodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Wittewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)         Vestem red         Thuja plicata         0.32	S-P-F South (US)				-	
Engelmann spruce         Picea engelmannii         0.35         64,000         8,900         30,900           Black spruce         Picea mariana         0.42         74,000         11,100         41,100           Red spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)	Sitka spruce	Picea sitchensis	0.40	70,000	10,800	38,700
Black spruce         Picea mariana         0.42         74,000         11,100         41,100           Red spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)         Vesterm red         Thuja plicata         0.32         51,700         7,700         31,400           Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana	Engelmann spruce	Picea engelmannii	0.35	64,000	8,900	30,900
Red spruce         Picea rubens         0.40         74,000         11,400         38,200           White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)         C	Black spruce	Picea mariana	0.42	74,000	11,100	41,100
White spruce         Picea glauca         0.36         65,000         9,600         35,700           Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)         C         C         C         C         C         C           Western red         Thuja plicata         0.32         51,700         7,700         31,400           Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000 </td <td>Red spruce</td> <td>Picea rubens</td> <td>0.40</td> <td>74,000</td> <td>11,400</td> <td>38,200</td>	Red spruce	Picea rubens	0.40	74,000	11,400	38,200
Balsam fir         Abies balsamea         0.35         63,000         10,000         36,400           Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)             7,700         31,400           Maskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         36,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum	White spruce	Picea glauca	0.36	65,000	9,600	35,700
Jack pine         Pinus banksiana         0.43         68,000         9,300         39,000           Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)	Balsam fir	Abies balsamea	0.35	63,000	10,000	36,400
Red pine         Pinus resinosa         0.38         72,400         10,300         37,600           Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)	Jack pine	Pinus banksiana	0.43	68,000	9,300	39,000
Lodgepole pine         Pinus contorta         0.41         65,000         9,200         37,000           Whitewood (EU) <sup>5</sup> Picea abies         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)             7,700         31,400           Western red         Thuja plicata         0.32         51,700         7,700         31,400           Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Red pine	Pinus resinosa	0.38	72,400	10,300	37,600
Whitewood (EU) <sup>5</sup> Picea ables         0.38         72,000         10,200         36,500           Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)             7,700         31,400           Western red         Thuja plicata         0.32         51,700         7,700         31,400           Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Lodgepole pine	Pinus contorta	0.41	65,000	9,200	37,000
Sitka spruce (UK) <sup>5</sup> Picea sitchensis         0.34         67,000         8,100         36,100           Cedar (US)	Whitewood (EU)⁵	Picea abies	0.38	72,000	10,200	36,500
Cedar (US)         Thuja plicata         0.32         51,700         7,700         31,400           Western red         Thuja plicata         0.32         51,700         7,700         31,400           Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Sitka spruce (UK) <sup>5</sup>	Picea sitchensis	0.34	67,000	8,100	36,100
Western red         Thuja plicata         0.32         51,700         7,700         31,400           Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Cedar (US)				-	
Alaskan yellow         Chamaecyparis nootkatensis         0.44         77,000         9,800         43,500           Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Western red	Thuja plicata	0.32	51,700	7,700	31,400
Port Orford         Chamaecyparis lawsoniana         0.43         88,000         11,700         43,100           Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Alaskan yellow	Chamaecyparis nootkatensis	0.44	77,000	9,800	43,500
Incense         Libocedrus decurrens         0.37         55,000         7,200         35,900           California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Port Orford	Chamaecyparis lawsoniana	0.43	88,000	11,700	43,100
California redwood         Sequoia sempervirens         0.35-0.40         54-69,000         7,600-9,200         36-42,400           Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	Incense	Libocedrus decurrens	0.37	55,000	7,200	35,900
Bald cypress         Taxodium distichum         0.46         73,000         9,900         43,900	California redwood	Sequoia sempervirens	0.35-0.40	54-69,000	7,600-9,200	36-42,400
	Bald cypress	Taxodium distichum	0.46	73,000	9,900	43,900

See footnotes on back cover.

### Major softwood species, commonly exported – mechanical and working properties (metric)<sup>1,2</sup>

	Shear parallel to grain (kPa)	Side hardness (N)	Durability <sup>7</sup>	Treatability <sup>8</sup>	Working qu	alities		
					Machining	Splitting resistance	Screw/nail- holding	Gluing
			Slightly durable	Easy				
	10,400	3,900			*****	*****	*****	*****
	11,600				*****	*****	*****	*****
	9,600	3,100			*****	*****	*****	*****
	9,600	3,100			*****	*****	*****	*****
	6,200	1,700	Slightly durable	Easy	*****	*****	*****	*****
			Slightly durable	Easy				
	7,800	2,000			*****	*****	***	*****
	7,800	1,700			*****	*****	****	*****
	7,200	1,900			*****	*****	****	*****
	11,300		Slightly durable	Easy				
	11,000	3,300	Not durable	Easy				
	14,400	5,500	Moderately durable	Easy				
				Moderately easy				
	8,600				*****	*****	*****	*****
	7,200				*****	*****	*****	*****
	6,200				*****	*****	*****	*****
	7.600				*****	*****	*****	*****
	7,200				*****	*****	*****	*****
	8,400				*****	*****	*****	*****
	7,800-10,400		Moderately durable	Difficult	*****	*****	*****	*****
	11.600			Difficult				
			Sliphtly durable	Difficult				
	9.400	3.700	Slightly durable	Moderately easy	*****	*****	*****	*****
				Moderately easy				
		·	Not durable	Difficult				
	7.900	2.300			*****	*****	*****	*****
	8.300	1.750			*****	*****	*****	*****
	8 500	2400			****	****	****	*****
	8900	2 200			+++			*****
	6.700	1.800			*****	*****	*****	*****
	6.500	1.700			*****	*****	*****	*****
	8 100	2 500			-	-		
	7.200	2,200			*****	*****	*****	*****
	6100	2 100			+++**	+++	****	+++
-	9.800		Slightly durable	Difficult				
	8 700		Not durable	Difficult				
_	6.800	1.600	Durable	Difficult	****	****	****	****
	7.800	2,600	Durable	Difficult		++++	++	
	9.400	2,000	Durable	Moderately.easy		++++	++	-
	6100	2 100	Durable	Difficult	++++		++	
	6 500-7 600	1900-2100	Durable	Difficult		++++	++	
	0,000-7,000	1,700-2,100	Durable	Difficult				

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- <sup>1</sup> Source: USDA Forest Products Laboratory, Wood Handbook Wood as an Engineering Material, 2010.
- Results of tests on clear specimens at 12% moisture content in air-dried conditions, from Table 5–3a of the Wood Handbook, 2010. Definition of properties: compression parallel to grain is also called maximum crushing strength; compression perpendicular to grain is fibre stress at proportional limit; shear is maximum shearing strength.
- Specific gravity is based on weight when ovendry and volume when at 12% moisture content.
- Modulus of elasticity measured from a simply supported, centre-loaded beam, on a span depth ratio of 14/1. To correct for shear deflection, the modulus can be increased by 10%.
- Source: Lavers, Strength Properties of Timber, 1983.
   Source: CIRAD (French Agricultural Research for Development) website.
- Durability refers to decay resistance of the heartwood.
- 8 Treatability refers to the ease of treating sapwood.

### European durability classes (BS EN 350-1)

Class	Description	Mean life (years)
1	Very durable	25+
2	Durable	15-25
3	Moderately durable	10-15
4	Slightly durable	5-10
5	Not durable	less than 5