A Guide to American Softwood Species

AMERICAN SOFTWOODS

Sustainability—Quality—Versatility

AmericanSoftwoods.com

Introduction

Softwoods have been exported from the United States for over 400 years. Today, America is recognized world-wide 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

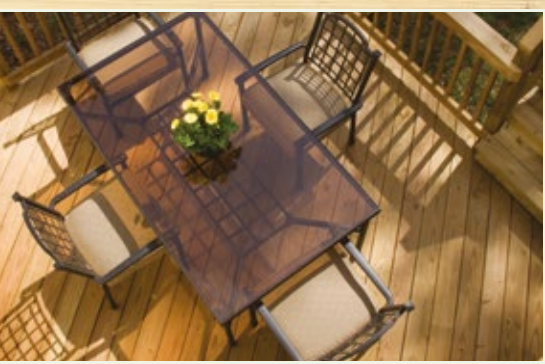
Help tackle climate change – use more wood

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_2 emissions) to harvest and convert into finished products than any other construction material
- Growing trees remove CO_2 from the atmosphere and give off life-sustaining oxygen
- Wood products store CO_2, keeping it out of the atmosphere while stimulating the expansion of managed forests, which absorb yet more CO_2.

Southern Yellow Pine

Pinus palustris, Pinus elliottii, Pinus echinata and Pinus taeda



Working properties

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

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.

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

Working properties

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

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.

Physical & mechanical properties

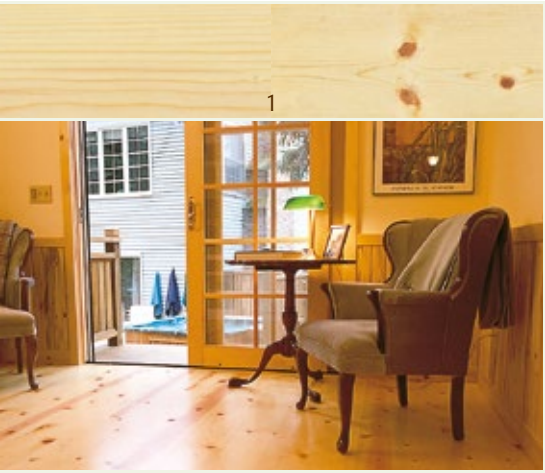
See chart on pages 18/19. Medium texture. Weight ranges from 390-415 kg/cubic metre. With its fine grain and uniform texture, it has good manufacturing qualities and holds finishes well.

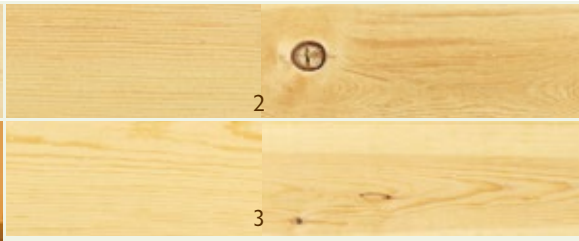
Durability

Slightly durable. Easy to treat.

Western pines

Pinus spp.





Working properties

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

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)*[1], Sugar pine *(Pinus lambertiana)*[2] and Idaho White pine *(Pinus monticola)*[3] 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. 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

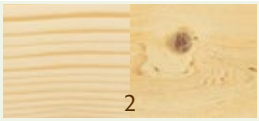
See chart on pages 18/19. Ponderosa pine is light and soft-textured, with a uniform, close, straight grain that is delicately figured after dressing. It seasons well, with a minimum of warping and cupping. Sugar pine has low volumetric shrinkage and a uniform texture. Idaho White pine has exceptional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

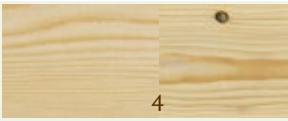
Durability

Slightly durable. Easy to treat.

Hem-fir

Tsuga heterophylla and Abies spp.





Working properties

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

General description

A species combination of the five true firs: California Red fir *(Abies magnifica)*[1], Grand fir *(Abies grandis)*, White fir *(Abies concolor)*[2], Noble fir *(Abies procera)*[3] and Pacific Silver fir *(Abies amabilis)*[4] with Western hemlock *(Tsuga heterophylla)*[5]. 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.

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

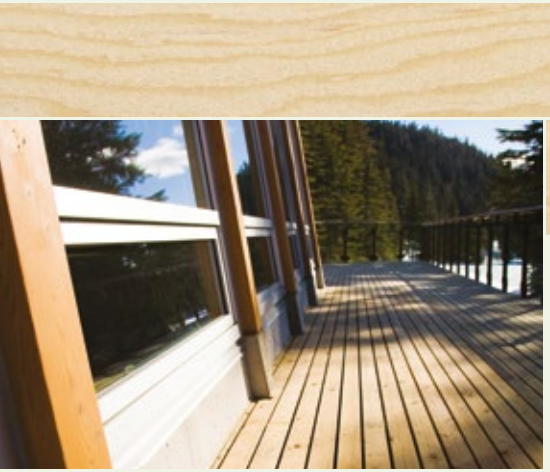
See chart on pages 18/19. Straight grain and fine texture. Sands to a silky smoothness with virtually no tendency to split. Weight ranges from 537 to 626 kg per cubic metre. Knotty appearance grades for joinery; lower knotty grades for general construction. Good strength and stiffness. Good insulating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

Durability

Slightly durable. Moderately easy to treat.

Western hemlock

Tsuga heterophylla



Working properties

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

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.

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.

Photo courtesy of www.naturally-wood.com

Douglas fir

Pseudotsuga menziesii

Working properties

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

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 high-performance 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.

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 strength-to-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

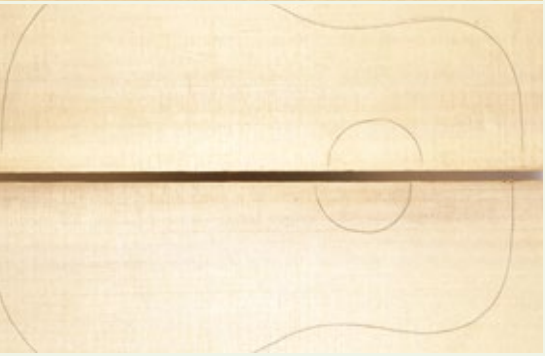
Moderately durable. Difficult to treat - incising is recommended for maximum penetration of preservative.

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

Machining	★★★☆☆
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

Working properties

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

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.

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

Working properties

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

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.

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.

Photo courtesy of Western Red Cedar Lumber Association

Other species

California redwood
Sequoia sempervirens

Found exclusively in Northern California, this coastal redwood is grown commercially in natural stands. The sapwood is cream-coloured 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.

Working properties

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

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.

Working properties

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

Incense cedar

Libocedrus decurrens

Fine and uniformly textured with a distinctly spicy odour. Its sapwood is white or cream-coloured, 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
★★★★☆

Comparative table

Species	Botanical name	Specific gravity[3]	Modulus of rupture (kPa)	Modulus of elasticity (Mpa)[4]	Compressive strength parallel to grain (kPa)
Southern Yellow Pine (US)					
Longleaf	Pinus palustris	0.59	100,000	13,700	58,400
Slash	Pinus elliottii	0.59	112,000	13,700	56,100
Shortleaf	Pinus echinata	0.51	90,000	12,100	50,100
Loblolly	Pinus taeda	0.51	88,000	12,300	49,200
Eastern white pine (US)	Pinus strobus	0.35	59,000	8,500	33,100
Western pines (US)					
Ponderosa	Pinus ponderosa	0.40	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)[6]	Pinus sylvestris	0.43	83,000	10,000	45,000
Radiata pine	Pinus radiata		80,700	10,200	41,900
Caribbean pine	Pinus caribaea		115,100	15,400	59,000
Hem-fir (US)					
Western hemlock	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
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	0.46-0.50	82-90,000	10,300-13,400	43,000-51,200
Douglas fir (UK)[5]	Pseudotsuga menziesii	0.44	91,000	10,500	48,300
Douglas fir (EU)[6]	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)[6]	Larix decidua	0.60	90,000	11,800	52,000
S-P-F South (US)					
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 resinosa	0.38	72,400	10,300	37,600
Lodgepole pine	Pinus contorta	0.41	65,000	9,200	37,000
Whitewood (EU)[5]	Picea abies	0.38	72,000	10,200	36,500
Sitka spruce (UK)[5]	Picea sitchensis	0.34	67,000	8,100	36,100
Cedar (US)					
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

See footnotes on back cover.

Major softwood species, commonly exported – mechanical and working properties (metric)[1,2]

Shear parallel to grain (kPa)	Side hardness (N)	Durability[7]	Treatability[8]	Working qualities			
				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				
		Slightly durable	Moderately easy				
8,600				★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆
7,200				★★☆☆☆	★★★★☆	★★★☆☆	★★★★☆
6,200				★★☆☆☆	★★★★☆	★★★☆☆	★★★★☆
7,600				★★☆☆☆	★★★★☆	★★★☆☆	★★★★☆
7,200				★★☆☆☆	★★★★☆	★★★☆☆	★★★★☆
8,400				★★☆☆☆	★★★★☆	★★★☆☆	★★★★☆
7,800-10,400		Moderately durable	Difficult	★★★☆☆	★★★☆☆	★★★★☆	★★★☆☆
11,600		Slightly durable	Difficult				
n/a		Slightly durable	Difficult				
9,400	3,700	Slightly durable	Moderately easy	★★★☆☆	★★★☆☆	★★★★☆	★★★☆☆
n/a		Slightly durable	Moderately easy				
		Not durable	Difficult				
7,900	2,300			★★★☆☆	★★★★☆	★★☆☆☆	★★★★☆
8,300	1,750			★★★☆☆	★★★★☆	★★☆☆☆	★★★★☆
8,500	2,400			★★★☆☆	★★★★☆	★★☆☆☆	★★★★☆
8,900	2,200			★★★☆☆	★★★★☆	★★☆☆☆	★★★★☆
6,700	1,800			★★★☆☆	★★★★☆	★★☆☆☆	★★★★☆
6,500	1,700			★★★☆☆	★★★★☆	★★☆☆☆	★★★★☆
8,100	2,500			★★★☆☆	★★★★☆	★★★☆☆	★★★★☆
7,200	2,200			★★★☆☆	★★★★☆	★★★☆☆	★★★★☆
6,100	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	2,800	Durable	Moderately easy	★★★★☆	★★★★☆	★★☆☆☆	★★☆☆☆
6,100	2,100	Durable	Difficult	★★★★☆	★★★★☆	★★☆☆☆	★★★★☆
6,500-7,600	1,900-2,100	Durable	Difficult	★★★★☆	★★★★☆	★★☆☆☆	★★★★☆
6,900	2,300	Durable	Difficult	★★★☆☆	★★★★☆	★★★★☆	★★★☆☆

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AMERICAN SOFTWOODS

[1] Source: USDA Forest Products Laboratory, Wood Handbook – Wood as an Engineering Material, 2010.
[2] 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.
[3] Specific gravity is based on weight when ovendry and volume when at 12% moisture content.
[4] 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%.
[5] Source: Lavers, Strength Properties of Timber, 1983.
[6] Source: CIRAD (French Agricultural Research for Development) website.
[7] 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