



Wood Flooring Made From Forest Restoration Material

Throughout the West, our National Forests face an increased risk of catastrophic wildfire because of an overabundance of dense, overstocked forest stands. To restore our forests to a healthy state, stands need thinning.

The USDA Forest Service and U.S. Department of Interior have targeted more than \$30 billion over the next decade to reduce hazardous fuels, restore damaged ecosystems, and help communities better protect themselves from catastrophic forest fires. A big part of this effort includes working with communities, entrepreneurs, researchers, and others to search for profitable uses for logs with diameters as small as 4 inches.

Small-diameter and low-valued forest thinnings have many potential uses. The key is finding the right use within the economics of the location, manufacturing process, and potential markets.

Prime Market

Wood flooring constitutes a prime market for millions of board feet of lumber cut from high-quality hardwood and softwood species.

The popularity of wood flooring has continued for centuries. The extensive and prolonged use of wood for

flooring indicates that it possesses special properties, qualities, and characteristics that are particularly desirable for this use:

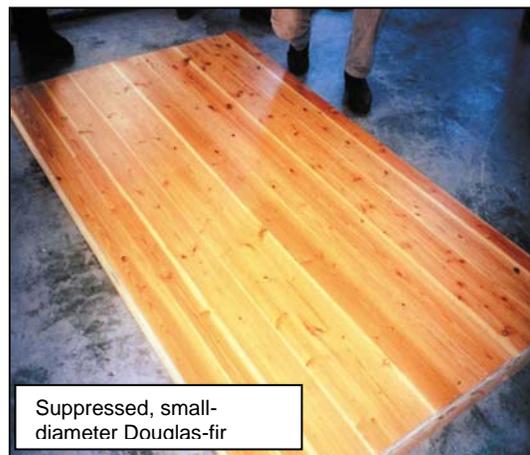
- Distinctive and attractive appearance, with wide latitude for adaptability to the style and motif of the home
- Good hardness and wearing qualities, yet with a degree of resilience that provides comfort
- Low heat conductivity, which ensures a feeling of warmth to the touch
- Simplicity and facility of installation
- Relative freedom from slipperiness (depending upon the finish used)

Hardwoods or Softwoods?

Although hardwood species are generally more popular as a flooring material, higher density softwood species are also used. Softwood species that are regularly manufactured into flooring include Southern Pine, Douglas-fir, western hemlock, and western larch. Hardness and shrinkage values for these species are summarized in Table 1. Hardness values of these softwoods are 33% to 53% less than those of red oak, and the softwoods are 12% to 35% more stable (a standard hardwood comparison used by the flooring industry).



Suppressed, small-diameter western larch



Suppressed, small-diameter Douglas-fir



Table 1- Hardness and shrinkage values

Softwoods	Property		Relative to red oak	
	Hardness (lb)	Shrinkage coefficient	Hardness (%)	Stability (%)
Species average				
Douglas-fir				
Coast	710	0.00267	-45	+28
Interior North	600	0.00241	-53	+35
Western larch	830	0.00323	-36	+12
Southern Pine				
Shortleaf	690	0.00271	-47	+27
Longleaf	870	0.00263	-33	+29
Western hemlock	540	0.00274	-35	+26
Northern red oak (ref).	1,290	0.00369	—	—
Suppressed, small-diameter trees				
Douglas-fir	864	—	—	—
Western larch	886	—	—	—

Small Diameter or Large Diameter?

Some literature erroneously suggests that wood cut from small-diameter trees is weaker than wood cut from large-diameter trees. USDA Forest Service research has established that the properties of wood from small-diameter trees may be just as good as those from large-diameter trees. Because flooring is a high-value product that can be produced from small-diameter softwood trees, there is considerable interest in how the properties of such material compare with those traditionally assumed for western softwood species.

The physical and mechanical properties of small-diameter trees thinned from overstocked stands are dependent upon species, age of the tree, and conditions under which the tree is growing. As part of a Forest Service evaluation of utilization options for wood salvaged from forest thinnings, the Forest Products Laboratory evaluated the hardness of two species currently being used in the West for finish flooring—Douglas-fir and western larch.

Several Douglas-fir 2 by 4s (from suppressed-growth trees) were provided by Jefferson State Forest Products, Hayfork, California, and a limited amount of western larch flooring was provided by North Slope Sustainable Wood, LLC (Missoula, Montana). The larch flooring was cut from suppressed, small-diameter trees growing in Montana.

Janka hardness tests were conducted on 120 Douglas-fir 2 by 4s and 23 pieces of western larch flooring that had been conditioned to a moisture content of 12%. The results indicate that the suppressed Douglas-fir showed hardness values were 22% to 44% greater than species average hardness values commonly assumed for Douglas-fir. The western larch results were about 6% greater than commonly assumed for larch. It should be cautioned that these property values may not be typical of small-diameter trees of a young age or trees growing in more open stands (such as plantations). This caution is especially important for shade-intolerant trees such as larch.