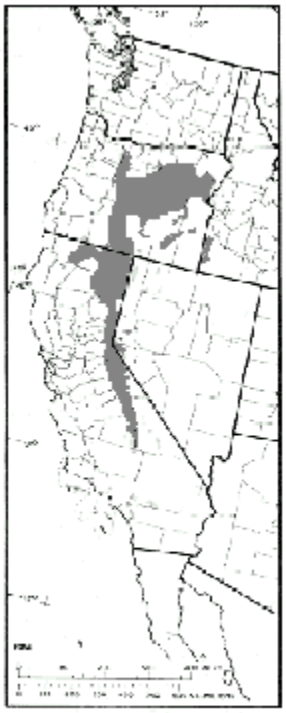
Western Juniper Factsheet

Western juniper (*Juniperus occidentalis*) trees are a common sight in the high desert of eastern Oregon, southwestern Idaho, and northeastern California. Juniper trees have been described as looking like "polka-dots on the hillsides".



Native Range of Western Juniper

Western juniper populations have expanded and contracted over the last 7,000 years. Within the last 150 years or so, the population and acreage covered by western juniper has increased three- to ten-fold. This expansion has many ranchers and resource professionals concerned about juniper's impacts on rangeland conditions. Juniper are known to out-compete surrounding vegetation for already scarce water resources. An area with relatively high juniper densities often has little to no understory vegetation.

Juniper have historically been removed in order to improve rangeland conditions. Unfortunately, little to no use has existed for the wood aside from fence posts or firewood. In an effort to better utilize this resource, a cooperative effort involving private companies and government agencies began around 1991.

Juniper harvesting and manufacturing processes have been studied. Physical and mechanical properties have been examined and markets for a wide variety of juniper products have been explored. Examples of products that have been explored include: cement/woodfiber composites, particleboard, hardboard, fencing, decking, wall paneling, flooring, veneer, furniture, and novelty items. To date, the most significant hurdles to a "booming" juniper industry are high harvest costs (short, highly-tapered and very limby trees combined with few trees per acre) and lack of a steady supply of raw material to the manufacturers.

Western juniper heartwood is highly durable (similar to redwood and cedars) and has aromatic properties like its close relative eastern redcedar (*Juniperus virginiana*). The color of the wood varies from milky white to deep reddish-brown and has large, swirling grain patterns and bands of heartwood mixed with sapwood, similar to eastern redcedar. Tests have shown juniper wood to machine, glue, and finish well. Once dried, juniper wood shrinks and swells less than many other Pacific Northwest species such as Douglas-fir, ponderosa pine, and western redcedar. Juniper has some unique bending properties. After being soaked in hot water, thin (1/32"-1/16") samples have been tied into intricate knots without splitting.

Juniper wood is slightly denser than ponderosa pine. The wood is also quite hard for a softwood: about 35% harder than ponderosa pine, but only about ½ as hard as red oak. Juniper is about 70% as stiff as ponderosa pine, and 85% as stiff as incense-cedar, meaning the wood deforms relatively easily under loads. The table below compares some of the mechanical and physical properties of western juniper with other commonly used woods.

Mechanical and Physical Properties of Western Juniper and Other Commonly Used Woods

Species	Specific Gravity @12% MC	Density (lbs/ft^3) @12% MC	Compression Strength-parallel to grain @12% MC (psi)	MOE-Bending Stiffness @12% MC (Million psi)	MOR-Bending Strength @12% MC (psi)
western juniper	0.44	31	5115	0.79	8540
Coastal Douglas-fir	0.48	34	7230	1.95	12400
ponderosa pine	0.40	28	5320	1.29	9400
eastern redcedar	0.47	33	6020	0.88	8800
incense-cedar	0.37	25	5200	1.04	8000
northern red oak	0.63	44	6760	1.82	14300
red alder	0.41	29	5820	1.38	9800

Species	Hardness @12% MC (lbs.)	Volumetric Shrinkage (%)	Nail Withdrawal Strength (side grain) (psi)	Machining	Gluing	Finishing	Bending
western juniper	665	7.95	197	VG	E	E	VG
Coastal Douglas-fir	710	12.4	184	G	VG	F	F
ponderosa pine	460	9.7	117	VG	VG	G	P
eastern redcedar	900	7.8	175	VG	E	E	?
incense-cedar	470	7.7	96	E	E	E	P
northern red oak	1290	13.7	363	VG	F	F	E
red alder	590	12.6	124	VG	E	?	?

Specific Gravity- Similar to density. Calculated as the weight of a sample of wood (oven dry) divided by the weight of an equal volume of water. In this instance, the wood's volume was measured when the wood was at 12% moisture content. Another way to look at specific gravity is- If a wood species has a specific gravity of 0.44, then the wood is 44% as heavy as water.

Density- Density of the wood in lbs. per cubic foot at 12% moisture content.

Compression Strength- Answers the question, "How strong is the wood when used as a column, such as a wall stud?". Determined by loading a wood sample as a column and recording the stress (psi) at the proportional limit. The proportional limit is a point on a graph of deformation versus load. The proportional limit is the point at which there is no longer a straight-line relationship between load (lbs.) and the amount the wood column deforms in inches. A low compression strength indicates the wood may crush fairly easily if used as a support column.

Bending Stiffness- Answers the question, "How **stiff** is the wood when bent like a floor joist?". Determined by loading a wood sample as a beam and recording the stress (psi) at the proportional limit. (see discussion of compression strength above for a description of proportional limit). A low stiffness value indicates the wood may be "spongy" or "springy" if not adequately supported in decking. Long, unsupported spans would be unwise for floor joists.

Bending Strength- Answers the question, "How **strong** is the wood when bent like a floor joist?". Similar to bending stiffness, except the wood beam is loaded until it breaks. Note the distinction between stiffness and strength. Stiffness is how easily the wood bends, strength is how much force it takes to break the sample.

Hardness- Answers the question, "How resistant is the wood to wear and marring, such as when used for flooring?". Hardness is measured by recording the amount of force it takes to embed a 0.444 inch diameter ball to half its diameter into the wood. A low hardness value means the wood would dent easily if used in flooring.

Volumetric Shrinkage- Answers the question, "How stable is the wood?". Table values are percent shrinkage from green to ovendry. This value is useful for comparisons to other species. As an example, a ponderosa pine board will shrink, on the average, 9.7% in total volume from green to oven dry. Western juniper will only shrink 82% as much as ponderosa pine. Actual inches of shrinkage in the radial and the tangential direction may be calculated using published shrinkage coefficients.

Nail Withdrawal Strength- Answers the question, "How well does the wood hold a nail?". Measured as the amount of force required to pull a nail from the wood. A low nail withdrawal value would indicate that nails may pop up easily if the wood shrinks or swells or that nailed joints may be excessively weak. Table values for species other than western juniper are estimated using a formula from the USDA's Wood Handbook.

The last 4 properties (machining, gluing, finishing, and bending) in the table are subjective. The table lists those properties as: E (excellent), VG (very good), G (good), F (fair), or P (poor).

Machining- How well does the wood machine? Does the wood tend to burn or chip during cutting, surfacing, and moulding operations?

Gluing- Does the wood glue well? Do chemical extractives in the wood prevent the formation of strong bonds?

Finishing- How easy is it to keep a finish on the surface?

Bending- How well does the wood bend? Does the wood split during bending?

Values for western juniper from Dr. Ed Burke, School of Forestry, University of Montana. Other values are from the Wood Handbook: Wood as an Engineering Material, USDA Forest Service, Forest Products Laboratory, Ag. Handbook #72, 1987.