REDWOOD

The Environmental Advice

Redwood Empire

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Redwood

The Natural Choice for Green Building

Decks have always made a statement about their owners. With redwood, consumers can also make a statement about their environmental consciousness.

Redwood is a sound environmental choice – a renewable, recyclable and biodegradable resource grown and harvested in accordance with some of the highest environmental standards in the world. From conserving energy to absorbing greenhouse gases, no other building material offers the environmental advantages that come naturally with redwood.

Private redwood forestland in Northern California.

Sustainability Guaranteed

The redwood that becomes beautiful decks, fences, gazebos and more is grown exclusively along California's central and north coast. With most old-growth redwoods preserved in public holdings, virtually all redwood decking and fence materials come from privately owned second- and third-growth forests.

A full 80 percent of California's managed redwood forests are certified as sustainable and well managed under the nation's two leading independent forest certification programs. Plus, all privately owned redwood forests are subject to California's stringent forestry regulations. State laws protect water quality, conserve wildlife habitat and ensure sustainability, meaning that California's redwood forests will stand tall for generations.

A 2003 study by the California Polytechnic State University – San Luis Obispo compared state regulations with certification requirements and found that California's forestry requirements are almost universally as strict or stricter than independent certification program standards.

So you can be confident California grown wood comes from sustainable forests. And if it's redwood, it's California grown. ■

Redwood Forests and Greenhouse Gases

Redwoods are the fastest growing softwood tree species in North America, making managed redwood forests perhaps the most efficient scrubbers of greenhouse gases in the world.

When trees grow, they absorb the greenhouse gas carbon and release oxygen through photosynthesis. The faster the tree grows, the more carbon it removes from the atmosphere and stores in its trunk, branches and roots.

Older trees grow at a slower rate than younger trees, so they don't remove as much carbon from the air. In fact, very old trees may decay faster than they grow, so they could release more carbon than they absorb. A 300-year old redwood may hold carbon from the days of the Revolutionary War and California's gold rush, but it isn't doing much to absorb carbon today.

Managed redwood forests provide optimal growing and carbon-absorption conditions. Furthermore, by harvesting trees after their peak carbon-absorbing years, much of the carbon they removed from the atmosphere stays trapped in wood products like decks and fences. New redwoods, planted by foresters or naturally sprouted, continue the carbon-removal cycle at maximum efficiency.

Managed redwood forests remove millions of tons of carbon from the atmosphere every year.

Energy – Consider the Source

Most green building standards emphasize greenhouse gas emissions and energy consumption when evaluating building materials. The energy to grow redwood comes from the sun. The energy to extract and process plastics, concrete and other manufactured materials comes from burning fossil fuels. Burning fossil fuels spews greenhouse gases into the air and has been closely linked to global warming.

Furthermore, much of the energy used to power sawmills and produce finished redwood lumber is clean biomass energy. Bark, wood chips, scraps and sawdust from mill operations are used to generate energy on-site. Some redwood mills even generate excess electricity for California's power grid. ■

Redwood products store carbon long-term in beautiful decks, fences and other outdoor projects.

Did You Know?

Redwood forests today cover more than 1.7 million acres in California.[1] About 95 percent of the land that was redwood forest when European settlers arrived on the West Coast is still redwood forest today.[2] More than 350,000 acres of redwoods and 95 percent of all old-growth redwood forests have been set aside in public parks and preserves.[3]

When the 1906 earthquake struck, the quake or subsequent fires destroyed most of San Francisco. Since so many redwood buildings were left standing in the wake of those devastating fires, the city required that all new buildings be constructed of redwood, stone or metal. ■

Choose Redwood for Green Living

	Redwood	Concrete, plastics & other manufactured materials
Renewable resource	Y	N
Reduces greenhouse gas emissions	Y	N
Reduces landfill impact	Y	N
Clean energy source	Y	N

Sources

1. USDA Forest Service.

2. Barbour, Michael. Coast Redwood: A Natural and Cultural History, Cachuma Press, 2001.

3. California Department of Forestry and Fire Protection.

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TECHNICAL DATA SHEET

Redwood

Using Redwood: An Environmentally Sound Decision

Wood is a renewable resource and redwood, as the fastest growing softwood in the nation, is one of our most renewable building materials...

Redwood is a popular building material due to its beauty and long-lasting performance, but the question arises: If I choose to build with redwood, what is the effect on the environment? The answers given here are based on independent studies and reports by experts from, among others, the U.S. Forest Service, the California Department of Forestry and Fire Protection and the California Board of Equalization.

The Redwood Parks

The most productive forest land in the United States lies in a narrow strip along the California coast from just north of the Oregon border to Monterey County south of San Francisco. Here may be found 1.74 million acres[1] of the nation's tallest trees, the Coast Redwood (*Sequoia sempervirens*).

Redwoods are preserved in more than 350,000 acres of parks and reserves...

The most spectacular groves of redwoods are found at the mouths of rivers and on river benches where periodic flooding over time deposited layers of nutrient-rich soil. Unlike other trees, redwoods were able to put out new roots into each fresh layer and thrive while other species suffocated and disappeared. These small groves of very large, old trees are relatively rare and are not typical of most of the redwood forest. They probably never exceeded 10 percent of the total redwood forest area.

These groves are the best of the redwoods and they have been preserved. In fact, no other commercial species in the world has had so great a proportion of its trees set aside forever in government parks and other reserves.

There are in excess of 350,000 acres of land in public ownership in the Redwood Region. These are comprised of Redwood National Park, the federal monuments, state parks and forests, national forests, city and county parks and other public reserves and administratively withdrawn lands.[2] Of this, 78,500 acres are held by the National Park Service, 186,000 acres are in state parks, 51,100 are in a state-owned forest and 35,200 are in the other public reserves. In addition to the 140,100 acres of young redwood forests withdrawn in the public parks and reserves, a total of 98,500 acres of outstanding old groves are preserved here.[3]

The redwood companies operating today all have deep roots in the history of the Redwood Region, and all have donated or transferred superlative groves of trees in their holdings to Save the Redwoods League, Nature Conservancy, the State of California and other public agencies for preservation in parks.

In addition to the Coast Redwoods that are preserved, 95% of the other redwood species, the Giant Sequoia, is preserved in state parks and groves...

In addition to the numerous parks in the North Coast area, 95 percent of the acreage of the state's other redwood species—the Giant Sequoia (*Sequoiadendron gigantea*) of the Sierra Nevada—is preserved in state and federal groves.[4]

Clearly, hundreds of thousands of acres of redwood parks and groves have been preserved forever.

The Commercial Redwood Forest

The commercial redwood forests tend to be different in nature from the parklands. These forests are seldom 100% redwood; typically, they are a mixture which can include redwood, Douglas fir, white fir, hemlock and hardwoods.

Tree nurseries operated by the forest industry produce more than 4.5 million redwood seedlings annually for reforestation programs...

The other major difference between the two types of forests is that today's commercial forests are predominantly young growth. These are privately-owned lands where redwood mills and tree farmers have planted and grown redwood trees specifically to be harvested. Less than 5% of today's redwood lumber production comes from old-growth forests. The redwood industry is relying on young-growth timber for the bulk of its production.[5]

Land that can sustain and nurture redwood trees is extremely valuable, and the private owners take good care of this resource. Five major companies in the redwood region operate tree nurseries with a total output of more than 13 million seedlings annually —4.5 million of them redwoods[6]—to support their reforestation programs, and the productivity of all industrial redwood land is fully maintained after harvest. State law requires it and good business practice dictates it.

The species' own tenacity probably does even more to regenerate the redwood forest than the planting of seedlings. Redwood is the only softwood in the country that sprouts from stumps. These new young trees grow quickly, thriving on the existing, mature root system. In some areas, early pioneers were actually unable to clear redwood forests to make pasture land. The trees kept returning in spite of all their efforts.

Redwoods are harvested under the most stringent regulations in the world...

Today, California's Forest Practice Act, the strictest in the nation, requires that every harvest operation must be reviewed in advance and approved by the California Department of Forestry and Fire Protection. If an adequate number of trees are not left on the harvest site to make up the new forest, state law requires the landowner to replant to assure that a new stand is established. The law further requires the State Board of Forestry "...to provide for protection of soil, air, fish and wildlife, and water resources."

The young growth commercial redwood forest is home to bear, deer, owls, salmon and many other forms of wildlife...

The commercial redwood forest is home to many species of birds, fish and mammals. Redwood lumber companies employ biologists to study these animals in the ever-changing habitat of the growing forest. In addition to planting and growing hundreds of thousands of acres of trees, the companies in the Redwood Region conduct a variety of wildlife and fisheries enhancement programs, many of them in cooperation with the California Department of Fish and Game.

Redwood Resource Trends

There are more redwoods today than when man first harvested the species...

Young redwood forests are growing at a phenomenal rate. This is important because this growth, the natural production of wood fiber, is what will serve our construction needs in the future. As forests renew themselves through growth, they provide us with the materials we need for our own growth. In this respect, young forests are productive while over-mature forests are not. Young growing forests also serve to "scrub the atmosphere" by filtering the air and removing carbon dioxide. Researchers have found that over-mature trees in the old-growth forests may actually give off as much carbon dioxide as they consume, and decaying trees are carbon emitters.

A forest growing at 2 percent or more a year is considered a healthy forest, and growth of young-growth redwood forests is running overall at 2.9 percent annually with trees on some sites exceeding 6 percent a year.[7]

Growth rates are expected to accelerate rapidly in the young redwood forests during the twenty-first century, and annual redwood growth is projected by 2040 to reach a rate 28 percent greater than now.[8] Some forest industry experts expect to double the rate of timber growth on their lands by the year 2040.

The private timberlands owned by ranchers and others are posting especially large gains in growth over harvest. Growth on these lands is even now running at three times the rate of harvest, and future increases in production from these lands are considered to be inevitable, according to forestry experts.

A Final Note

A forest is a living biological entity, forever changing and renewing itself through successive stages of growth, death, decay and resurrection. California's redwood forest may be seen in two parts today. One part includes the more than 350,000 acres preserved in public parks and reserves, slowly reshaped by nature decade after decade. The other part is the growing, productive forest—a habitat for a wide variety of wildlife and a resource for man, managed to serve a number of needs and values.

Redwood. Natural Inspiration.

Enhancing the opportunities for creative expression

"I especially like combining the strength of redwood timbers and heavy hardware with the rich softness of radiused edges, stepped seams and articulated joinery," says designer/craftsman Timothy A. Jones of Oakland, California.

Jones has developed a reputation for landscape structures with an individual flair. He works in redwood almost exclusively. "Since my designs require so much milling and sculpting and must withstand the elements, the versatility and durability of redwood make it my only choice."

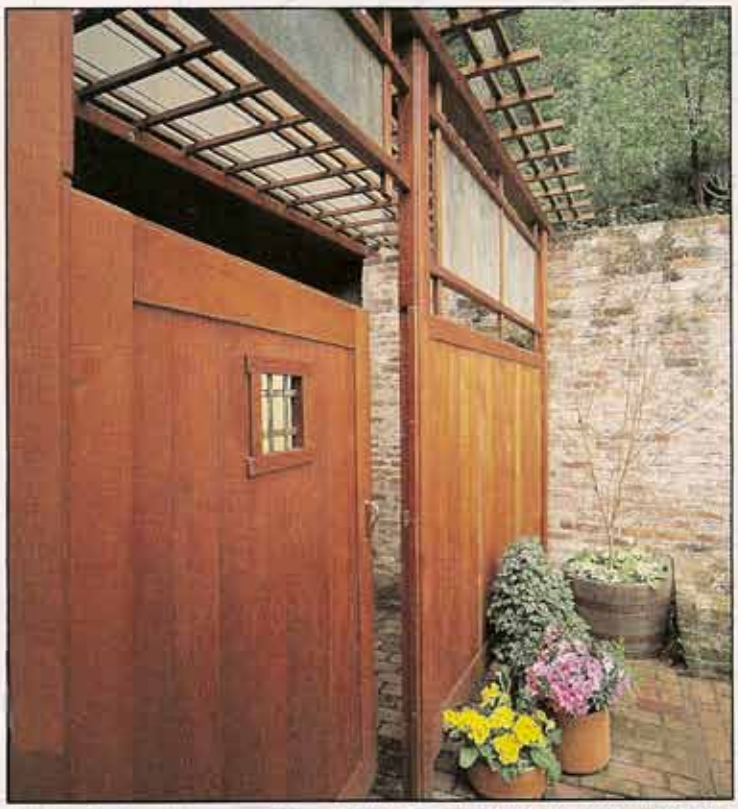
Jones employs hand-made copper hardware which he treats to produce a rich, green patina. "It's an effect you see in sculpture but seldom in garden structures. The patina contrasts nicely with the warm, inviting color of redwood."

His structures are built in modular form and assembled on site. He prefers brass screws to nails so he can retighten everything after the wood has fully seasoned.

Jones finds redwood extremely cooperative. "It's a versatile wood for solving problems; easy to sculpt and laminate," he observes. "I can add more layers to a canopy because it's lightweight. Also you don't get those terrible splinters you get working with other woods. And redwood lasts for years."

Discover the creative potential of redwood. Send for the free booklet ***Redwood Decks, Fences and Garden Structures.***

The curved sides of this arbor required ten separate laminations. Jones finds it easy to create curves using a urea-resin based glue and 3/16th redwood laminations.



This windbreak/privacy screen features sheets of copper, chemically aged overnight to a rich patina. The sheets are framed and mortised into the main timbers.

A penetrating oil finish with an ultraviolet light stabilizer preserves the richness of redwood that Jones finds so appealing. Iron hinges were forged by a local blacksmith and painted to prevent ferrous stains.

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TECHNICAL DATA SHEET

Redwood

Dimensional Stability of California Redwood

Redwood is much less subject to common defects associated with dimensional change. . .

Redwood has the least volumetric shrinkage of any commercial domestic wood; therefore, it can be subjected to considerably more change in moisture before it has the same change in dimensions as other commercial species. This means that projects manufactured with redwood will be much less subject to open joints, warping, cupping, splitting and other defects associated with dimensional change. Table 1 provides relative shrinkage values for a number of common domestic softwoods. These values are shown on a relative basis taking the values for old-growth redwood as 100 percent. Values over 100 indicate shrinkage greater than that for old-growth redwood.

Average relative shrinkage values. . .

Table 1. Average relative shrinkage values for common domestic softwoods

Species	Shrinkage from green to oven-dry condition based on dimensions when green		
	Radial	Tangential	Volumetric
Redwood, old growth	100	100	100
Redwood, young growth	85	111	103
Western redcedar	92	114	100
White fir	127	159	144
Baldcypress	146	141	154
Ponderosa pine	150	141	143
Douglas-fir (coastal)	185	173	182
Southern pine (loblolly)	185	168	181
Western hemlock	162	177	182

Water exists in green (unseasoned) wood in two conditions: as free water in the cell cavities and as bound water in the cell walls. When wood contains just enough water to saturate the cell walls, it is said to be at the fiber saturation point (FSP). Water in excess of this amount cannot be absorbed by the cell walls and, therefore, is free water in the

cell cavities. Removal of the free water from the cell cavities has no apparent effect on the properties of wood except to reduce its weight, but as soon as any of the bound water in the cell walls is removed, wood begins to shrink. Since the free water is the first to be removed, shrinkage does not begin until the FSP is reached.

Shrinkage is about twice as great across the flat grain face. . .

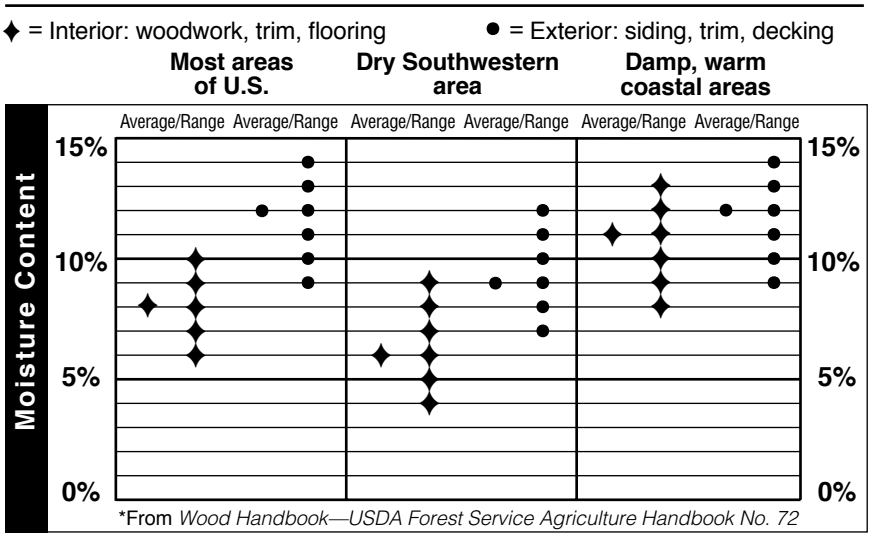
The FSP for wood varies from about 22 percent to 30 percent moisture content. For redwood, FSP can be taken as approximately 22 percent. Dimensional change does not occur until moisture content reductions from the green, or unseasoned, condition go below this value and the cell walls begin to give up bound water. Then redwood begins to shrink in all directions, although not uniformly. Generally speaking, the shrinkage is about twice as great across the flat grain face (tangential shrinkage) as it is across the vertical grain face (radial shrinkage). Longitudinal shrinkage is normally so small that it is generally not considered significant.

All woods contain certain quantities of chemical extractives in addition to the cellulose and lignin components. Redwood is rich in extractives which, combined with redwood's cellular structure, are responsible for its low shrinkage. In properly dried wood there is little appreciable difference between sapwood and heartwood with respect to dimensional change. Sapwood, however, may be more susceptible than heartwood to changes in atmospheric humidity; therefore, its dimensions may change more quickly than those of heartwood.

Moisture content critical at time of manufacture and installation. . .

Ideally, wood products should be manufactured and installed at the moisture content to which they will equilibrate in use. This moisture content is referred to as the equilibrium moisture content or EMC. Table 2 provides recommended moisture content values for various wood items at the time of installation.

Table 2. Recommended moisture content values for various wood items at time of installation*



*From *Wood Handbook—USDA Forest Service Agriculture Handbook No. 72*

Redwood general purpose grades are available green (unseasoned) or S-DRY (19 percent or less moisture content). Redwood architectural grades are available green, S-Dry or Certified Kiln Dried (CKD) in accordance with RIS *Standard Specifications for Grades of California Redwood Lumber*, paragraph 725.

The change in dimension within the moisture content limits of 6 to 14 percent, as defined in the *Wood Handbook*, Chapter 14-2, can be estimated by using dimensional change coefficients as follows:

To estimate change in dimension within a 6 to 14 percent moisture content limit. . .

$$\Delta D = Di [Ct (Mf - Mi)]$$

where: ΔD = change in dimension,
$D i$ = initial dimension (inches),
$C t$ = dimensional change coefficient, tangential direction (for radial direction, use Cr),
$M f$ = final moisture content (percent),
$M i$ = initial moisture content (percent).

Dimensional change coefficients for redwood:

	Cr (radial)	Ct (tangential)
old growth	.00120	.00205
young growth	.00101	.00229

Because lumber products rarely are perfectly flat grain (tangential) or vertical grain (radial), this calculation will usually overestimate tangential shrinkage and underestimate radial shrinkage.

Refer to <u>USDA Forest Service Wood Handbook</u> when moisture content is greater. . .

For approximate dimensional changes associated with moisture content changes greater than 6 to 14 percent, or when one moisture content value is outside of those limits, refer to USDA Forest Service *Wood Handbook*, Chapter 14-3.

A general rule of thumb is that redwood will shrink or swell approximately 0.7 percent in width for each 4 percent reduction or increase in moisture content below FSP.

The Technical Services Division of the California Redwood Association will be glad to assist you with any designs or problems where shrinkage is an important factor in wood utilization.