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WOOD FINISHING: WEATHERING OF WOOD

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How Wood Weathers

Weathering of wood involves changes in color, roughening and checking of the surfaces, loss of surface fibers, and warping. Without paint or treatment, wood exposed outdoors, such as siding and trim on buildings, changes materially in appearance in a few months or years. Then it stays almost unaltered for a long time.

The time required to produce a fully weathered appearance will depend on the severity of exposure to sun and rain. Attack of wood surfaces by micro-organisms is recognized also as a factor contributing to the degradation process of weathering.

The color of wood is rapidly affected by exposure to weather. Generally dark-colored woods become lighter and light-colored woods become a little darker. As the weathering continues, all woods become a gray color. Only the wood close to the surface is noticeably affected. Initially, the affected zone, usually brown in color, appears to penetrate the surface 0.02 to 0.10 of an inch. As weathering progresses, a gray layer, 0.003 to 0.01 inch thick, develops on the surface. This

1/ This Research Note is a slight revision, by W. C. Feist and E. A. Mraz, of FPL-0135, originally published in July 1966 by the Forest Products Laboratory.

layer is composed chiefly of cellulose, the most leach-resistant part of the wood. Lignin, the cementing material of wood cells, is degraded by light, and rain and dew will extract almost all of the lignin fragments, sugars, and extractives.

The defiberization, or loss of surface wood cells, occurs most rapidly in the thin-walled fibers of the springwood and at a much lower rate in the more dense summerwood. As fibers are lost from the surface, the brown and gray layers move more deeply into the wood. The process is quite slow and only about 1/4 inch of wood thickness is lost in a century.

The color changes in wood and the defiberization at the surface indicate chemical changes. Studies at the Forest Products Laboratory show that the weathering of wood involves a photo-oxidative mechanism. Significant quantities of carbon dioxide, carbon monoxide, and methanol were found as degradation products when wood was exposed to light and air. The degradation is influenced greatly by the wavelength of light; it is most severe when exposure is to light in the far ultraviolet region.

Weathering produces physical as well as chemical changes in wood. Exposure of wood to light and to natural weather conditions produces changes in the anatomy of the surface cells and also induces small microscale checks. As weathering progresses and extreme cycles of wetting and drying continue, most woods develop larger and deeper checks or cracks that are easily visible. Woods of a moderate-to-low density acquire fewer checks than do woods of high density. Edge-grain boards also check less than flat-grain boards.

As a result of weathering, boards tend to warp and pull at their fastenings. The warping tendency varies with density, width, and thickness of the board. The greater the density and the greater the width in proportion to the thickness, the greater the chances of warp. For best results, the width of boards should not exceed eight times their thickness. Warping also is more pronounced in flat-grained boards than in edge-grain boards.

The color and appearance of weathered wood can be affected, to a marked degree, by dark-colored spores and mycelia of fungi. When these grow on a wood surface, they contribute significantly to the dark gray, blotchy, and unsightly appearance of weathered wood. The clean, silvery appearance of weathered wood is associated with wood that weathers in very dry climates or in coastal regions where salt atmospheres may inhibit the growth of micro-organisms.

The color of weathered wood is influenced to a lesser degree by highly colored water-soluble wood extractives in such woods as western redcedar and redwood. These extractives gradually diffuse to the surface and produce a dark-brown color. This color may persist for long periods in protected areas not exposed to the sun, and where extractives are not removed from the wood surface by the washing action of rain.

Use of a Water-Repellent Preservative

A clean golden-tan color can be achieved and maintained in the weathering of the more popular siding species, such as redwood and western redcedar, by treating the surface to retard the accumulation of wood extractives and mildew on the surface. This method of treating consists of applying a solution of a water-repellent preservative to the wood surface.

The initial application of the water-repellent preservative is usually short-lived. When the surfaces start to show blotchy discoloration caused by extractives and mildew, the surface should then be cleaned by mild scrubbing with a detergent or trisodium-phosphate solution and retreated with another liberal brush or spray application of water-repellent-preservative solution.

Frequently it is necessary to clean and retreat the wood surface each year or two for the first few years. After this initial aging period, the treatment may last much longer and need be refinished only when the surface becomes unevenly discolored.

Nails

When wood weathers naturally, it is important that nails be highly resistant to rusting. Iron nails rust rapidly and produce a severe brown or black discoloration around the nail. Use corrosion-resistant nails, such as galvanized nails and especially aluminum or stainless steel nails, to avoid such difficulties.

Additional Information on Weathering of Wood

Microscale Changes in Cell Structure at Softwood Surfaces During Weathering, by V. P. Miniutti. In For. Prod. J., December 1964. (Vol. XV, No. 12) p. 571–576. Available from Forest Products Research Society, Madison, Wis. 53705.

Microscopic Observations of Ultraviolet Irradiated and Weathered Softwood Surfaces and Clear Coatings. U.S. Forest Service Research Paper FPL 74, May 1967, by Victor P. Miniutti. Available from U.S. Forest Products Laboratory, Madison, Wis. 53705.

Penetration of Light into Wood, by F. L. Browne and H. C. Simonson. In For. Prod. J., October 1957. (Vol. VII, No. 10) p. 304-314. Available from Forest Products Research Society, Madison, Wis. 53705.

Role of' Microorganisms in Weathering of Wood and Degradation of Exterior Finishes, by C. G. Duncan. In Official Digest, October 1963. (Vol. 35, No. 465) p. 1003–1012. Available from Federation of Societies for Paint Technology, Philadelphia, Pa. 19107.

Surface Characteristics of Wood as They Affect Durability of Finishes. U.S. Forest Service Research Paper FPL 57.
PART I .––Surface Stabilization, by Harold Tarkow, Carole F. Southerland, and Raymond M. Seborg.
PART II.––Photochemical Degradation of Wood, by Martin A. Kalnins.
Available from the U.S. Forest Products Laboratory, Madison, Wis. 53705-

Water–Repellent Preservatives. U.S. Forest Service Research Note FPL–0124, 1973. Available from U.S. Forest Products Laboratory, Madison, Wis. 53705.

Wood Siding Left to Weather Naturally, by F. L. Browne. In Southern Lumberman, December 15, 1960., p. 141–143.