RESEARCH in Progress

Advanced Housing Research Center
Forest Products Laboratory
Madison, Wisconsin

Enhanced Utilization of Northeastern Tree Species through Preservative Treatment

Large areas of forest in the northeastern United States are increasingly dominated by tree species that have relatively little commercial lumber value. The proportion of traditionally valuable species in these forests has declined because of selective harvesting. The commercial value of some alternative species would increase if they could be adequately penetrated with preservatives and subsequently shown to be durable in outdoor exposures. This increased value would give forest managers more flexibility in economically managing the forest resource and preserving more traditional commercial species. Adding value to previously underutilized wood species would also create business and employment opportunities in rural communities.

Stake evaluations of the durability of wood used in ground contact.

Concurrently, challenges have also arisen in the area of wood preservatives and preservation. Use of chromated copper arsenate (CCA)—the preservative that dominated the treated-wood market for over 25 years—was sharply curtailed by the end of 2003 because of concerns about arsenic exposure. Several potential replacements for CCA are becoming commercially available, but there has been relatively little independent research on their ability to treat or protect wood. Research that has been done with these preservatives has been largely limited to Southern Pine species, which are easily treated. There is a great need to evaluate the ability of these new preservatives to penetrate the more refractory wood species and to protect these species from decay and insect attack in a range of outdoor exposures.

Background

Opportunities for utilization of northeastern species such as balsam fir, eastern spruce, eastern hemlock, and red maple could be improved if they could be treated to American Wood Preservers' Association (AWPA) standards and used in durable wood structures. During the 1990s, the northeastern market for pressure-treated lumber and timbers grew by 20% per year. The Northeast is also home to more than 60 facilities for preservative treatment of wood, treating 6 billion board feet of lumber, timbers, and plywood annually. However, before a wood species can be standardized for treatment with a particular preservative, adequate penetration and retention through the use of conventional pressure treatment processes must be demonstrated. Because of unique interactions between wood and preservative chemistries, adequate treatment does not always ensure durability for all species–preservative combinations. Thus, the durability of the treated wood must also be evaluated through exposure of test specimens in conditions that are at least as severe those that would be encountered in service.

Concerns about arsenic in CCA-treated wood have led to the recent development of arsenic-free alternative preservatives. Arsenic-free alternatives that have recently been standardized by the AWPA include alkaline copper quat (ACQ), copper azole (CBA), and copper citrate (CC). These arsenic-free preservatives contain increased levels of copper as the primary biocide and may also incorporate a co-biocide to prevent attack by copper-tolerant fungi. They are all water-based systems, which are generally less expensive than solvent-based systems and leave the wood with a dry, paintable surface. These arsenic-free preservatives have a range of properties that are very different from those of CCA, and these differences can affect both their ability to penetrate various wood species and the subsequent durability of the treated wood.

Objectives

This research program will address two specific objectives:

- To evaluate the degree of preservative penetration and retention that can be achieved in underutilized

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northeastern species when pressure treated with conventional and arsenic-free alternative preservatives

- To evaluate the above-ground and ground-contact durability of these species when treated with each type of preservative

This information will allow us to address the broader objective of evaluating the potential use of these wood species in outdoor, durable product applications.

Approach

The FPL has initiated a four-pronged research approach to evaluated treatability and durability with these wood species–preservative combinations:

Treatability—End-matched specimens cut from lumber of each species are being pressure treated with each type of preservative using controlled, reproducible treatment processes. Following treatment, the degree of preservative penetration and retention in each specimen is measured and compared with the appropriate AWPA standard requirements.

Fungal Cellar Durability—The FPL fungal cellar is designed to provide an accelerated evaluation of the ability of a species–preservative combination to withstand severe soft-rot attack. Thin specimens cut from each wood species are treated with a range of concentrations of each preservative and exposed in the soft-rot soil beds. The samples are periodically removed and non-destructively tested for their modulus of elasticity (MOE), which is highly correlated with the degree of soft-rot attack.

Field Stake Evaluations—The FPL maintains an outdoor exposure site in cooperation with the Forest Service Harrison Experimental Forest (HEF) near Gulfport, Mississippi. The HEF site presents a severe challenge of wood durability because of the high degree of fungal and subterranean termite activity. Stakes cut from each wood species are treated with a range of concentrations of each preservative and buried to one-half their length in the forest soil. Each year the stakes are pulled and visually evaluated for the degree of fungal and termite attack

Decking Evaluations—Above-ground durability will be assessed at the FPL exposure site near Madison, Wisconsin. Decking specimens cut from each wood species are treated with each preservative and fastened to a simulated deck structure. Each year, the specimens will be visually evaluated for decay, insect attack, dimensional stability (warp, twisting, checking), and overall appearance.

In each of the durability evaluations, the performance of each specimen is compared with those of both untreated controls and a standard preservative (CCA) and wood species (Southern Pine).

Expected Outcomes

This research program will allow us to determine if (1) these underutilized wood species can be treated with these preservatives in a manner that will meet AWPA Standards, (2) these species treated with these preservatives have sufficient durability to be used in outdoor, ground-contact applications, and (3) these species treated with these preservatives have sufficient durability to be used in outdoor, above-ground applications. If warranted by the research results, this information may be used as part of a data package that will seek AWPA standardization of these preservative–wood species combinations.

Timeline

This treatability portion of this research was begun in 2002 and concluded in 2003. The durability evaluations began in 2003 and will take several years to produce definitive results.

Cooperators

This research program is being conducted through the cooperative efforts of the USDA Forest Products Laboratory (FPL), State and Private Forestry, Northeastern Forest Alliance, Vermont Department of Forest, Parks and Recreation, preservative manufacturers, and cooperating lumber producers in the Northeast. Cooperating mills have supplied white pine, eastern spruce, Balsam fir, eastern hemlock, and red maple lumber in a range of dimensions to the FPL. Cooperating preservative manufacturers provided chromated copper arsenate, copper citrate, alkaline copper quat, and copper azole wood preservative formulations for use in the study.

Contact Information

Stan Lebow, Research Forest Products Technologist
Bessie Woodward, Microbiologist
USDA Forest Service
Forest Products Laboratory
Madison, WI 53726-2398
(608)-231-9200