RESEARCH in Progress

NATIONAL CENTER FOR WOOD TRANSPORTATION STRUCTURES

# Naturally Durable Wood Species for Repair and Rehabilitation of Aboveground Components in Covered Bridges

Covered bridges are historical masterpieces that were designed for protection from the elements, thereby allowing untreated wood components to remain serviceable for decades. However, protecting all wood components continuously from all sources of moisture exposure is impractical. Some areas of the structures, such as weatherboarding and wood members near the ends of the bridges, are particularly susceptible to wind-driven precipitation. Chronic exposure to moisture or wet and dry cycling from rain can increase the moisture content of wood components sufficiently to allow for biological attack by fungi and insects.

**In covered bridges, naturally durable wood species are an attractive option for replacement components that are protected from moisture**

## Background

Covered bridge designers had to rely on local sources of wood and whenever possible fashioned bridge components using woods known from experience to be naturally durable. As stands of old-growth materials diminish and availability of alternative wood species expands beyond locally grown materials, naturally durable alternatives should be considered for replacement components during rehabilitation of covered bridges. Some underutilized and invasive wood species have shown surprising durability against biological agents and need to be evaluated for durability in laboratory and aboveground field testing. Aboveground field performance in untreated wood is an indicator of natural durability. Restoration of historic structures with naturally durable wood species instead of chemically treated components conforms better to the original bridge design and reduces environmental concerns associated with the use of chemically treated wood over water. Chemical extractives from naturally durable wood species can be analyzed for components responsible for natural durability against biological organisms that attack wood. Those extractives may then be used to develop environmentally friendly preservatives or coatings to protect less-durable wood components of covered bridges.

## Objectives

This project has three main objectives:

1. Assess field performance of naturally durable wood species in accelerated aboveground field tests in high and moderate decay hazard zones

2. Assess effectiveness of chemical extractives from naturally durable wood species in laboratory tests against decay fungi and termites

3. Characterize chemical components of extractives that successfully inhibited decay fungi and termites for

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potential development as "green" wood preservatives

## Approach

Underutilized wood species will be assessed for natural durability in accelerated aboveground deck tests in both high and moderate decay hazard zones of the United States. Untreated specimens will be evaluated annually for 3 years and compared with non-durable Southern Pine and highly durable western redcedar. Concurrently, chemical extracts from the wood will be evaluated in laboratory tests for biocidal activity. Extracts that successfully inhibit decay fungi and termites in laboratory tests will be analyzed for their chemical makeup. Field performance data will be correlated with laboratory results to create a recommendation for using underutilized or invasive wood species for replacement of aboveground covered bridge components in protected outdoor exposure.

## Expected Outcomes

- Manual of recommendations for use of underutilized durable woods for repair and replacement of aboveground components of covered bridges
- Basic understanding of the chemical extractives responsible for imparting durability to lesser-known durable wood species
- Potential application of chemical extractive(s) for "green" wood protection systems for less durable wood species

## Timeline

Fabrication and installation of aboveground field tests in Mississippi and Wisconsin will be completed by fall 2009; annual inspections will occur during 2010, 2011, and 2012, with continued monitoring over 5 years. Studies on chemical extractives from the same wood species will begin in 2010 and continue through the end of 2011. The final report will be completed in 2012, with a report addendum to be developed at the conclusion of 5 years of field performance monitoring.

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