RESEARCH in Progress

Forest Products Laboratory

Use of Exotic-Invasive Species in Wood–Plastic Composite Profiles

Problems associated with exotic-invasive species have prompted FPL scientists to search for potential uses for these species. Wood–plastic composites (WPCs) are a potential value-added material in which exotic-invasive species can be incorporated. To further investigate this potential, we must determine (1) if WPCs can be manufactured using exotic-invasive species and (2) the fundamental differences between WPCs manufactured using conventional wood flour species such as pine and those manufactured using exotic-invasive species.

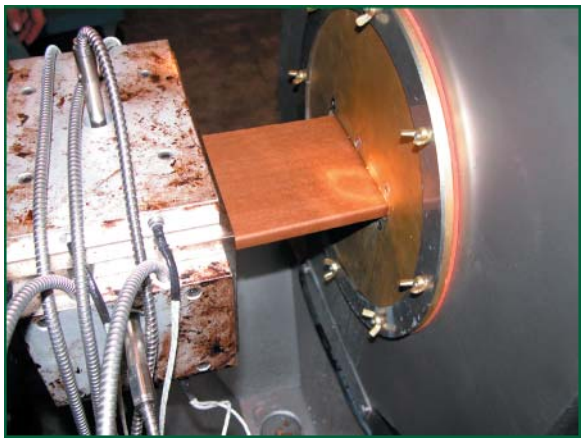

Figure 1. Profile extrusion of HDPE containing 50% salt cedar and additives. The composite melt is exiting the extruder die (left) and entering the cooling tank (right).

Background

Exotic-invasive species are fast encroaching into indigenous ecosystems in the United States. A host of environmental problems have resulted, including increased fire danger, topsoil erosion, reduced groundwater, and reduced stream flows. These species are commonly removed from rangeland and burned because the fiber from shrubby exotic-invasive species has few identified value-added uses. To offset the costs associated with removal, and to promote rangeland restoration, scientists at the Forest Products Laboratory (FPL) are actively working to identify uses for exotic-invasive species.

One outlet that holds promise is WPCs. Pine wood flour is the most common wood-based material used in WPCs, typically accounting for 40% to 60% of the composite by weight. Currently, tremendous growth is occurring in non- or semi-structural applications such as decking, siding, and roofing. Scientists at the FPL are developing and evaluating the use of exotic-invasive species, particularly salt cedar (*Tamarisk* spp.) and one-seed juniper (*Juniperus monosperma*), in WPCs for exterior applications.

Objectives

This research is working toward three primary objectives:

- To demonstrate the feasibility of manufacturing WPCs using exotic-invasive species
- To understand the fundamental differences between exotic-invasive species and pine wood flour that impact processing and performance
- To determine how using salt cedar and juniper will change the weatherability of WPCs from pine-based WPCs

Approach

FPL researchers worked with the Bureau of Land Management to obtain small-diameter salt cedar thinnings from Arizona and juniper chips from Utah. The salt-cedar and juniper were broken down and screened into wood flour at the FPL. FPL researchers manufactured WPCs using a typical pine wood flour mixture sourced commercially and compared the processability with WPCs manufactured using the exotic-invasive species.

The wood was compounded with high-density polyethylene (HDPE), maintaining a 50% wood content. The composites were compounded in a twin-screw extruder with a strand die, and the strands were

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pelletized and dried before being fed to a single-screw extruder for profiling. The extruded profile was 5 by 0.5 in. (Figure 1). It was demonstrated that wood flour derived from exotic-invasive species can be used for profile extrusion.

Having shown that WPC profiles can be manufactured using salt cedar and juniper, researchers are currently working to optimize these composites for processability and durability. Analytical methods are being used to investigate differences in wood flour composition and their effects on thermal stability, processing, and performance. Additionally, WPCs are being evaluated for their weatherability using both accelerated and natural weathering methods (Figure 2).

Expected Outcomes

Results will be used to promote the use of exotic-invasive species in wood–plastic composites. We anticipate that this project will establish an outlet for exotic-invasive species, thereby improving public lands.

Timeline

Evaluations of suitability for processing are underway and will be completed by 2008. The composites are currently installed in the field, and evaluations will continue through November 2010.

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Figure 2. Racks of salt-cedar-, juniper-, and pine-based composites installed in Madison, Wisconsin, to test weathering characteristics.