Heat Treatment of Firewood to Meet Phytosanitary Standards

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A detailed overview of USDA's research and field demonstrations on heat-treating firewood to prevent the spread of emerald ash borer (EAB). The article explains the required temperature standards, kiln operation methods, monitoring systems, and successful applications across firewood facilities in the United States.

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The movement of untreated firewood has been a major factor in the spread of the emerald ash borer (EAB), an invasive pest responsible for devastating ash tree populations in North America. To stop its spread, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) established federal heat-treatment requirements to ensure that firewood shipped across state lines is free from pests.

Background

Emerald ash borer infestations have led to severe ecological and economic damage across the United States and Canada. The USDA estimates that if uncontrolled, EAB could cost local governments and homeowners billions of dollars in tree removal and replacement over the coming decades. The primary method to prevent further spread is to ensure that all transported firewood is properly heat-treated.

Under the federal quarantine regulations, all hardwood firewood must undergo heat sterilization. The current USDA standard requires that the core temperature of the wood reach at least 60 degrees Celsius (140 degrees Fahrenheit) for a continuous period of 60 minutes. This standard was updated from the previous requirement of 71 degrees Celsius (160 degrees Fahrenheit) for 75 minutes, which was found to exceed international standards due to EAB's higher heat tolerance.

Heat Treatment Procedures

To achieve full sterilization, firewood must be heated evenly throughout its core. This is accomplished by using specialized kilns or heating chambers designed to maintain consistent airflow and temperature distribution. The heating process requires accurate monitoring to ensure compliance with phytosanitary standards.

The treatment cycle begins with loading firewood into the kiln and inserting temperature probes into the largest logs, usually at the center of the batch. Monitoring systems record both the air temperature inside the kiln and the core temperature of the wood pieces. The process continues until the required temperature and duration are achieved, followed by controlled cooling and moisture removal.

Temperature Monitoring Systems

Precise temperature monitoring is essential for ensuring compliance and certification. USDA research identified two main sensor types used in firewood heat treatment: resistance temperature detectors (RTDs) and thermocouples (TCs). RTDs provide highly accurate readings but are more fragile and expensive. Thermocouples, on the other hand, are robust and cost-effective, making them ideal for field operations.

Field demonstrations used data loggers capable of recording and storing temperature data from multiple probes at once. Systems typically cost between one and two thousand dollars, depending on the number of sensors. A reliable monitoring setup includes multiple thermocouples, a data acquisition device, and a computer for real-time analysis and documentation.

Field Demonstrations

The Forest Products Laboratory and its partners conducted heat-treatment demonstrations at four firewood facilities in Wisconsin, Illinois, and Indiana. Each site used different kiln configurations, heating sources, and monitoring equipment.

In Wisconsin, a modified dry kiln powered by a wood-fueled hot water boiler successfully reached target temperatures of up to 81 degrees Celsius (178 degrees Fahrenheit). Another Wisconsin facility utilized dual kilns adapted from shipping containers, achieving certification under both EAB and gypsy moth standards.

In Illinois, a gas-fired direct kiln with integrated sensors and digital monitoring achieved consistent compliance. Meanwhile, an Indiana site demonstrated the use of thermocouples and digital loggers in smaller-scale operations, providing cost-effective verification for compliance reports.

Training and Certification

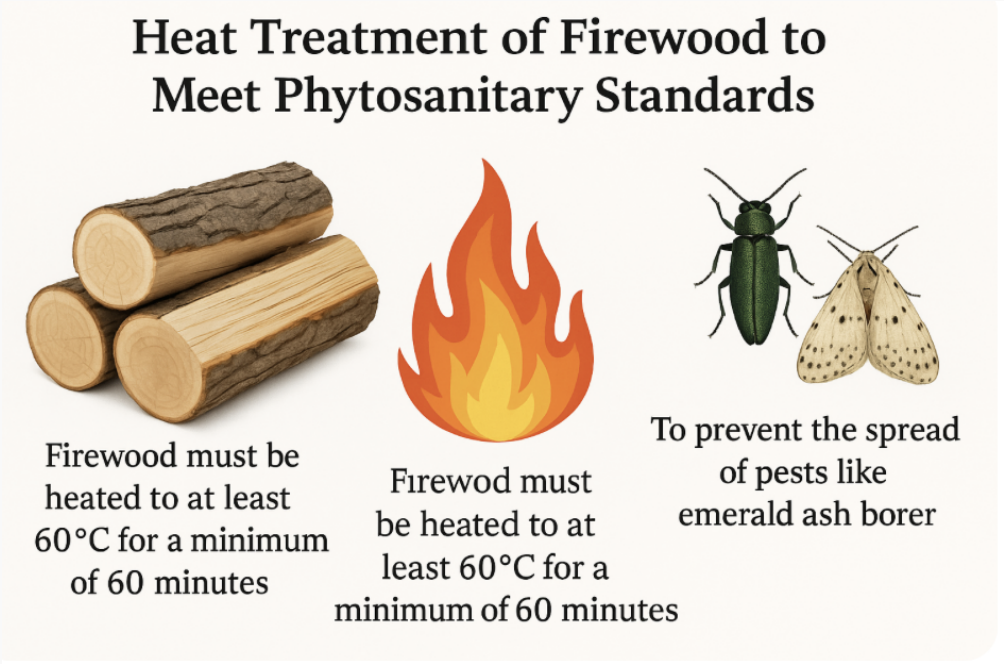
The USDA and cooperating state agencies provided training workshops and webinars for kiln operators and inspectors. These sessions covered certification procedures, temperature monitoring methods, calibration of sensors, and proper documentation. Each certified facility is required to maintain compliance records, including temperature history files, to verify adherence to phytosanitary requirements.

Conclusion

The implementation of standardized heat-treatment practices for firewood has become an essential part of controlling invasive pests like the emerald ash borer. Through applied research, field demonstrations, and training initiatives, the USDA and Forest Products Laboratory successfully developed cost-effective and reliable systems for meeting federal phytosanitary standards.

These advances not only protect North American forests but also allow firewood producers to continue interstate commerce with certified, pest-free products. The collaborative approach between federal agencies, researchers, and industry participants provides a model for future pest management and forest protection strategies.

Source: United States Department of Agriculture, Forest Products Laboratory, General Technical Report FPL–GTR–200.



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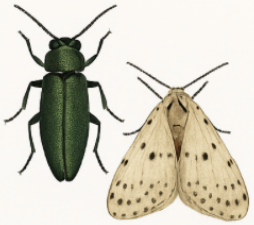

To prevent the spread of pests like emerald ash borer

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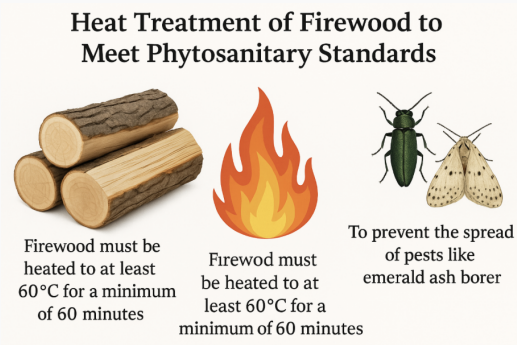
ISPM 15	Firewood Heat Treatment
TEMPERATURE	TEMPERATURE
56 °C (133 °F)	60 °C (140 °F)
TIME	PURPOSE
30 minutes	60 minutes

30 minutes	60 minutes
Wood packaging materials	Transported firewood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