



Fact Sheet 5.4

Invasive Species and Firewood Movement



Invasive species are one of the greatest concerns in southern forest management both in rural and urban environments. An organism is considered invasive if 1) it is nonnative to a particular ecosystem, and 2) its introduction is likely to cause economic or environmental harm, or harm to human health (Clinton 1999). Invasive species are usually thought of as nonnative or from another continent. However, invasive species can also be native to North America but exist outside of their historical range. Species can become invasive when limiting factors (such as temperature and precipitation) and natural control processes (such as predation, natural defense systems, and disease), which keep species populations in check and reduce their impact, are not present in the environment. Under such conditions, populations can become invasive as they grow and spread, disrupting the areas in which they live (*Box 1*).

Global trade and transportation are the main pathways through which species have traditionally moved into new places (National Plant Board 2010). Natural resource professionals are concerned that firewood movement has the potential to be another high-risk pathway for invasive species to enter new ecosystems. This fact sheet defines firewood, outlines types of invasive pests transported in firewood, and introduces firewood movement as a critical pathway for these species. It also gives examples of ecological, economic, and social effects of invasive pests, and it explains why the wildland-urban interface is an area of particular risk for the introduction and establishment of invasive species. As supplemental information, six

Box 1: Effects of Invasive Species

Preventing firewood movement is just one important step in stopping the spread of invasive species. Invasive species have infested hundreds of millions of acres of land and water across the nation, disrupting farmland, forest, prairie, mountain, wetland, river, and ocean ecosystems. In addition to affecting ecosystems, they can also cause harm to the economy or human health. Invasive species can affect the areas they invade by

- outcompeting and displacing native species,
- reducing biological diversity,
- reducing wildlife habitat value,
- killing forest trees,
- placing other species at risk of extinction,
- altering wildfire intensity and frequency,
- damaging crops,
- closing foreign markets to U.S. products from infested areas,
- costing millions of dollars in treatments to industry and government, and
- threatening recreational activities of hikers, bikers, campers, bird watchers, gardeners, hunters, boaters, and fishermen, as well as the livelihoods of farmers, loggers, and others.

Sources: U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine 2010; and U.S. Department of Agriculture, Forest Service 2004.

“species briefs” describe invasive pests that are thought to be transported in firewood and that have already affected southern ecosystems or have the potential to do so.

What Is Firewood?

Firewood is any split or unsplit wood less than four feet long, excluding products that are moved for further processing or are already regulated (National Plant Board 2010). Firewood can also be defined as wood that has been cut, sawn, or chopped into a shape and size commonly used for fuel, or other wood intended for fuel (7 CFR §301.92.2010). There are different sources of firewood and various types of firewood sold (Box 2). Firewood can be processed from healthy trees removed during silvicultural activities (thinning or harvesting of trees) or land clearing, and it can be processed from dead or dying trees.

Firewood that comes from healthy trees or that has been properly aged and seasoned can still attract invasive species when stored outdoors. The small eggs and larvae of invasive species are difficult to detect without careful inspection and sometimes laboratory testing is necessary to confirm their presence. Firewood is usually processed from trees that are unsuitable for other purposes and may have been stressed, crooked, damaged, diseased, insect-ridden, or dead. It is important to identify the cause of tree death, infection, or infestation because firewood processed from dead or dying trees can host invasive species. The invasive species can hide or lay dormant on or under the bark, or

inside the firewood itself, escaping detection. If that untreated and raw firewood is moved, the invasive species can spread into new areas.

Types of Invasive Pests

The term “invasive pests” is commonly used to describe invasive species that damage natural resources and agricultural crops (U.S. Department of Agriculture 2011a). Most of the invasive pests that are likely to be transported in or on firewood are insects or pathogens. Tree insects and pathogens can become invasive when a plant species does not have the appropriate defense system to protect itself from a pest with which it did not evolve. The following are a few examples of invasive insects that may travel on or in firewood; see the species briefs for more information on these invasive pests.

- *Wood borers* are insects that spend most of their life cycle feeding on and within wood. The Asian longhorned beetle (*Anoplophora glabripennis*) kills a variety of hardwood trees, such as maple, birch, poplar, willow, elm, and ash. The emerald ash borer (*Agrilus planipennis*) attacks and kills all North American species of ash. These two examples of wood-boring insects have unique life cycles that allow them to develop in firewood unseen for months or even years.¹
- *Tree defoliators* are insects that feed on the leaves of plants. The gypsy moth (*Lymantria dispar*) is a tree defoliator whose egg masses can easily move from place to place on the surface of items or materials stored outdoors, for example, lawn furniture, car tire wells, and firewood. The gypsy moth affects mainly oak species but also other hardwood trees, shrubs, and even pines.



Photo by: Robert Trickel

Firewood is often used for fuel.

¹Personal communication. 2012. Robert P. Trickel, Head, Forest Health Branch, North Carolina Forest Service, 1616 Mail Service Center, Raleigh NC 27699-1616.

Box 2: Types of Firewood

Three main types of firewood are sold: green, seasoned, and treated. Green and seasoned firewood can host invasive pests and, when transported, introduce a pest to a new area. Firewood can be treated to reduce the risk of spreading invasive pests. The purchase and use of local firewood (grown within a 50-mile radius of where it will be burned) is recommended because the risk of moving invasive pests is very low when firewood is burned close to where it was harvested. Below we identify characteristics of the three types of firewood:

- Green firewood is freshly cut wood that usually must be dried before burning. Green wood is white or lightly colored and poses the greatest risk because any insect or pathogen present in the wood has a greater probability of surviving transport to a new location.
- Seasoned firewood has been air dried typically for 6–12 months but sometimes as little as 3 months. Seasoned wood will have a lower moisture content and loose bark, it will be splitting or cracking at the ends, and it will have grayed if stored outside (Browning 2009). While this period of time may allow the wood to dry sufficiently for the purpose of burning well, insects and pathogens may still be present and living in the wood. Pests that inhabit seasoned firewood are often likely to be secondary, less aggressive species that do not attack live trees; therefore, seasoned firewood poses a lower risk than green firewood.²
- Treated firewood has been properly heat treated, kiln sterilized, or debarked to decrease the risk of transporting viable pests. Any treatment process should include proper inspection for risks and labeling to include the location of firewood production and the method of treatment. The preferred treatment depends on the type of pest to be eliminated.
 - Heat treating must occur in a facility that is certified by the U.S. Department of Agriculture and maintains a compliance agreement. This process raises the temperature of the center of the log to the minimum required and for the time specified; this is necessary to sterilize the firewood. Regulations specifying time and temperature requirements of this treatment (T314-a) can change over time. Check with the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine to find up-to-date information.
 - Kiln sterilization involves drying wood in an insulated chamber. There are many different kiln technologies and designs available. Kilns must allow for the control of temperature, humidity, and air circulation to meet the treatment standards of the U.S. Department of Agriculture (T404-b-4) for properly drying firewood. The maximum thickness of allowable wood is three inches for this treatment type.
 - Debarking is often achieved using a machine (debarker) that removes the bark and the outermost one-half inch of wood from firewood. This treatment method reduces the risk of transporting insects and pathogens living in, under, or on the bark, but it is not an effective treatment for insect pests or pathogens living in the wood. Heat treating and kiln sterilization are preferred treatment methods.

When purchasing firewood, consumers have several types from which to choose. The current recommendation is to buy and use local firewood when possible. If local firewood is unavailable, treated firewood is the next best option to minimize the risk of transporting pests.

Sources: Browning 2009; Minnesota Department of Agriculture; National Plant Board 2010; Reeb 1997; and U.S. Department of Agriculture, Animal and Plant Health Inspection Service 2010 and 2011d.

²Personal communication. 2012. Ronald Billings, Manager, Forest Health Program, Texas Forest Service, 200 Technology Way, Suite 1281, College Station, TX 77845.

Photo courtesy of: USDA Agricultural Research Service



In urban areas, infected trees are cut to control the Asian longhorned beetle.

Pathogens also pose a threat to natural resources and agriculture. *Plant pathogens* are any organism that can cause disease or damage in a plant (U.S. Department of Agriculture 2011b). Some plant pathogens use insects to transmit disease; these insects are called *vectors*. The pathogen and insect relationship can vary. In some cases the pathogen enters the plant tissue through a feeding wound caused by the insect; in other cases, the insect carries the pathogen on or in its body and from one plant to another (Barbercheck 2011). The following are examples of insect-vectored pathogens that may be transported in or on firewood; see the species briefs for more information on these invasive pests:

- The redbay ambrosia beetle (*Xyleborus glabratus*) carries a fungus (*Raffaelea lauricola*) that causes laurel wilt disease. Laurel wilt affects native species of the family Lauraceae, particularly redbay (*Persea borbonia*).
- Thousand cankers disease affects black walnut trees, resulting from the

association of the walnut twig beetle (*Pityophthorus juglandis*) with the fungus (*Geosmithia morbida*) (U.S. Department of Agriculture 2011c).

Firewood Movement

People often transport firewood for use during outdoor recreation associated with camping, fishing, hunting, ATVing, mountain biking, hiking, skiing, and rock climbing. Firewood movement can be classified according to the distance traveled. Moving firewood short distances can increase the local or *leading edge* dispersal of pests, which results in the gradual expansion of the pests' ranges into new areas. For example, campers often move firewood 100 or 200 miles (Jacobi 2007). Less often, firewood is moved greater distances and poses a risk for the long distance spread of pests. For example, commercial firewood distributors and regional or national retail distribution chains can move large volumes of firewood long distances. Lower volumes of firewood can still travel long distances with campers and outdoor enthusiasts for recreation purposes and with homeowners for use in heating homes and cabins in the winter (Jacobi 2007). Invasive pest movement by firewood can be the first step in the spread of an invasive species.



Photo by: ladyheart, everystockphoto.com

People often transport firewood for use during outdoor recreational activities.

Ecological, Economical, and Social Effects

Firewood movement poses ecological, economic, and social consequences in areas where invasive pests become established and cause harm to previously healthy trees. Invasive pests that cause disease such as chestnut blight have almost eliminated major tree species across their natural ranges, consequently affecting the structure of forest ecosystems. The economic costs associated with control and eradication of these pests are significant. For example, since its detection in the United States, the emerald ash borer (EAB) has cost the U.S. Department of Agriculture more than \$200 million to survey and control. The estimated costs for the removal and replacement of ash trees damaged or killed by EAB will exceed \$10 billion by the year 2020 (National Plant Board 2010). The cost of managing invasive pests in urban areas is particularly high in public areas and is necessary due to liability issues (Kovacs et al. 2010). Furthermore, invasive pests can affect the capacity of an ecosystem to provide the many ecosystem services people enjoy from forests, which can affect human well-being. Examples of these services include carbon sequestration, timber, watershed protection, nontimber forest products, climate regulation, and recreation opportunities. These are just a few examples of the many ecological, economic, and social effects of invasive pests.

Invasive Pests in Interface Areas

Of particular interest to researchers and natural resource professionals are invasive insects and pathogens that can move with firewood, become established in a new environment, and cause harm to healthy trees. Areas at the greatest risk of invasive pest introduction and establishment are those with high levels of human mobility and trade. As a result, urban and urbanizing areas are more susceptible

to the introduction of invasive pests than are rural forests. For example, the close proximity of forests to stored wood products, such as timber, firewood, and pallets, results in an increased likelihood of the introduction and establishment of invasive pests. A study of bark beetle movement found that storage time and proximity to forests had the greatest impact on the likelihood of the beetle's introduction and establishment (Skarpaas and Økland 2009). Invasive pests can also be exceptionally damaging in urban and urbanizing environments where ecological systems may already be stressed from factors such as drought, soil compaction, and barriers to root growth like sidewalks and buildings (Vitosh et al. 2008). Invasive pests threaten the quality of life and the property values of millions of urban residents across the country (National Plant Board 2010).

Summary

Firewood movement is a major pathway for the introduction of invasive pests, most likely insects and pathogens, to new ecosystems. Such pests can hide in firewood processed from healthy or diseased trees. These invasive pests can have ecological, economical, and social consequences for interface communities, which are particularly susceptible to the introduction and establishment of invasive pests. Recognizing this invasive pathway can help resource professionals stay up to date on the management of invasive species.

Suggested Resources

Don't Move Firewood is a Web site designed to educate the public about the dangers of moving firewood. It provides state-by-state information, describes "things you can do" to help address the issue, and identifies common pests transported in firewood. The site also contains a blog, videos, and games.

www.dontmovefirewood.org

The *National Plant Board (NPB)* is a nonprofit organization of the plant pest regulatory agencies of each of the states and Puerto Rico.

www.nationalplantboard.org/

The *National Firewood Task Force (NFTF)* includes members from the National Plant Board; the U.S. Department of Agriculture, Animal and Plant Health Inspection Service; the U.S. Forest Service; the National Association of State Foresters; and the U.S. Department of the Interior National Park Service. The task force was charged with two tasks: collecting stakeholder ideas for addressing firewood as a pest pathway and developing recommendations that, if adopted by state and federal officials and other parties, would result in lower pest and disease risks by people moving firewood. The NFTF released recommendations focused on three primary areas of action: outreach, voluntary efforts, and regulatory efforts.

http://nationalplantboard.org/docs/NFTF_Recommendations_Final_March_2010_1.doc

Stop the Beetle is a campaign and Web site by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service aimed at educating the public about the emerald ash borer (EAB). It explains what the EAB is, where it is currently found, the signs and symptoms of infestation, steps to stop the spread of EAB infestations, and games and other educational materials for children.

www.stopthebeetle.info/

The U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) State Plant Health Directors can answer questions related to animal and plant health or regulations and take reports of plant or animal pest or disease.

www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml

The *Federal and State Quarantine “Summary of Pest Regulations”* for each state is designed as a reference tool for nursery stock growers,

brokers, purchasers, and others involved in the buying, selling, and interstate transport of nursery and greenhouse plant crops. It outlines basic quarantine and other plant health requirements of APHIS, all 50 states, and Puerto Rico. This information is subject to frequent revision and may be incomplete or outdated.

<http://nationalplantboard.org/laws/index.html>

References

7 CFR §301.92.2010. U.S. Code of Federal Regulations, Title 7, Part 301, Subpart 92 (7CFR Ss 301.92-1—Domestic Quarantine Notices, *Phytophthora ramorum*, Definitions).

Barbercheck, M. 2011. *Ecological Understanding of Insects in Organic Farming Systems: How Insects Damage Plants*. Pennsylvania State University Extension System, <http://www.extension.org/pages/18903/ecological-understanding-of-insects-in-organic-farming-systems-how-insects-damage-plants>.

Browning, E. 2009. “All You Need to Know About Firewood.” *Joplin Independent*. http://www.joplinindependent.com/display_article.php/staff1232214324.

Clinton, William. 1999. “Invasive Species.” Executive Order 13112, February 3, <http://www.invasivespeciesinfo.gov/laws/execorder.shtml>.

Jacobi, W. 2007. *Pathways and Risk Assessment of Emerald Ash Borer Movement into and within the Western United States*. U.S. Forest Service and Colorado State University, <http://www.fs.fed.us/wwetac/projects/jacobi.html>.

Kovacs, K. F.; R. G. Haight; D. G. McCullough; R. J. Mercader; N. W. Siegert; and A. M. Liebhold. 2010. “Cost of Potential Emerald Ash Borer Damage in U.S. Communities, 2009–2019.” *Ecological Economics* 69: 569–578.

Minnesota Department of Agriculture.
Firewood Heat Treatment Guide,
[http://www.mda.state.mn.us/en/plants/
pestmanagement/eab/caguide/heattreatguide.aspx](http://www.mda.state.mn.us/en/plants/pestmanagement/eab/caguide/heattreatguide.aspx)
(accessed March 9, 2012).

National Plant Board. 2010. *National Firewood Task Force Recommendations*,
[http://nationalplantboard.org/docs/NFTF_
Recommendations_Final_March_2010_1.doc](http://nationalplantboard.org/docs/NFTF_Recommendations_Final_March_2010_1.doc).

Reeb, J. E. 1997. *Drying Wood* (FOR-55).
Lexington KY: University of Kentucky, College
of Agriculture, Kentucky Cooperative Extension
Service, College of Agriculture,
[http://www.ca.uky.edu/agc/pubs/for/for55/
for55.pdf](http://www.ca.uky.edu/agc/pubs/for/for55/for55.pdf).

Skarpaas, O. and B. Økland. 2009.
“Timber Import and the Risk of Forest Pest
Introductions.” *Journal of Applied Ecology* 46(1):
55-63.

U.S. Department of Agriculture, Animal and
Plant Health Inspection Service. 2010. *Treatment
Manual*, [http://www.aphis.usda.gov/import_
export/plants/manuals/ports/downloads/
treatment.pdf](http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf)

U.S. Department of Agriculture, Animal and
Plant Health Inspection Service. 2011a. *Hungry
Pests: They're Here and They're Hungry*,
[http://www.aphis.usda.gov/hungrypests/
overview.shtml](http://www.aphis.usda.gov/hungrypests/overview.shtml) (accessed January 9, 2012).

U.S. Department of Agriculture, Animal and
Plant Health Inspection Service. 2011b.
*Permits—Bacteria, Fungi, Nematodes,
Phytoplasmas, and Viruses*,
[http://www.aphis.usda.gov/plant_health/
permits/organism/plant_pathogens.shtml](http://www.aphis.usda.gov/plant_health/permits/organism/plant_pathogens.shtml).

U.S. Department of Agriculture, Animal and
Plant Health Inspection Service. 2011c. *Plant
Health—Thousand Cankers Disease*,
[http://www.aphis.usda.gov/plant_health/
plant_pest_info/tcd/index.shtml](http://www.aphis.usda.gov/plant_health/plant_pest_info/tcd/index.shtml).

U.S. Department of Agriculture, Animal and
Plant Health Inspection Service. 2011d. *Risk
Assessment of the Movement of Firewood within
the United States*, [http://www.aphis.usda.gov/
newsroom/hot_issues/firewood/downloads/
firewood_pathway_assessment.pdf](http://www.aphis.usda.gov/newsroom/hot_issues/firewood/downloads/firewood_pathway_assessment.pdf).

U.S. Department of Agriculture, Animal
and Plant Health Inspection Service. Plant
Protection and Quarantine. 2010. *Attack of the
Invasive Species*, [http://www.aphis.usda.gov/
publications/plant_health/content/printable_
version/attack_of_the_invasive_species.pdf](http://www.aphis.usda.gov/publications/plant_health/content/printable_version/attack_of_the_invasive_species.pdf).

U.S. Department of Agriculture, Forest Service.
2004. *National Strategy and Implementation Plan
for Invasive Species Management*, FS-805,
[http://www.fs.fed.us/foresthealth/publications/
Final_National_Strategy_100804.pdf](http://www.fs.fed.us/foresthealth/publications/Final_National_Strategy_100804.pdf)

Vitosh, M.; J. Iles; and M. Gleason. 2008.
*Sustainable Urban Landscapes: Understanding
Decline in Trees* (SUL2). Ames IA: Iowa State
University of Science and Technology,
Cooperative Extension Service, Forestry and
Horticulture, [http://www.plantpath.iastate.edu/
files/SUL2.pdf](http://www.plantpath.iastate.edu/files/SUL2.pdf).