

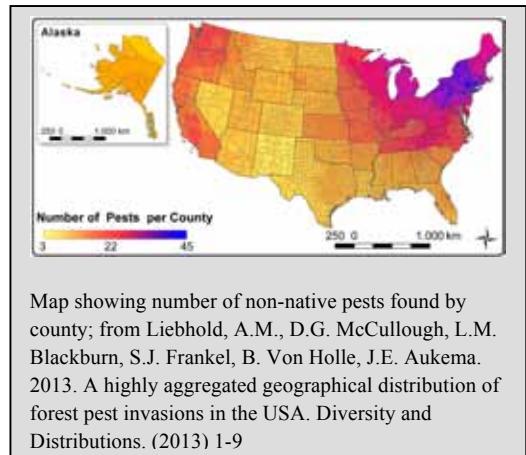
The Threat of Non-Native Forest Insects and Diseases

Since European settlement began in North America, nearly 500 non-native tree-feeding insects and disease-causing pathogens have been introduced into the United States. About 80 of these have caused notable damage to our trees.

Where Are the Pests?

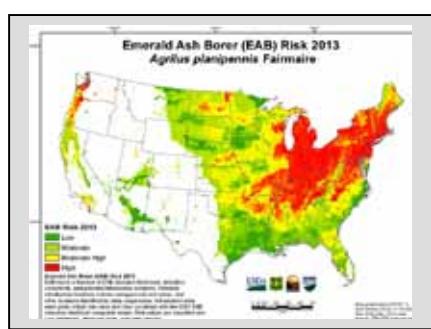
Most of these pests were introduced in the eastern half of the United States, from Maine to Minnesota and south to Tennessee and North Carolina. The highest number – up to 60 highly-damaging pests – have been introduced to Connecticut, New York, New Jersey, and Pennsylvania. Why? This region has a long history of importing goods from abroad, a pathway that imports pests as well. These states' forests are home to a wide variety of trees and shrubs, each susceptible to its own group of non-native pests.

However, no part of the country has been spared. While fewer in number, non-native insect and pathogen species in the South and West have all-but-extirminated iconic trees from large portions of their native ranges. Fraser fir and whitebark pine are examples.



The Destruction of American Forests

Hardwood trees have suffered the greatest destruction, especially trees that produce nuts. American chestnut has been so depleted that is no longer a functioning part of its ecosystem. The oaks that replaced it are periodically attacked by European gypsy moths. Also, oaks face new threats from winter moth, oak wilt, and, possibly, sudden oak death. Butternut trees have been nearly obliterated from most of the tree's range by butternut canker. American beech trees once reached above the forest canopy. Now, in a band from Maine to West Virginia, they can form only dense thickets of sprouts because of beech bark disease. Conservationists fear that black walnut will be severely reduced by thousand cankers disease if it spreads; it is already established in Pennsylvania, Tennessee, Virginia, Ohio, and North Carolina.



The emerald ash borer has killed perhaps 60 million ash trees in the upper Midwest. Hundreds of millions of trees are in imminent danger as the pest continues to spread. Ash trees grow throughout the East and Midwest, as well as in riparian areas in the Great Plains and West.

Maples, birches, elms, and willows across America are at risk from the Asian longhorned beetle. Of the several locations where the insect is found, two stand out: Worcester,

Massachusetts, and Clermont County, Ohio. The risk is high that insects from one or both places will escape eradication and spread.



In the Southeast. Redbay trees and related shrubs in coastal regions of the Southeast are rapidly dying from laurel wilt disease. The widespread sassafras tree also succumbs to the pathogen. No one knows whether the disease can persist in areas without redbay or can tolerate cooler temperatures outside of the far South.

In the Appalachians. Eastern hemlock has been severely diminished in much of its range from southern New England to Georgia and Alabama. The future is uncertain for Carolina hemlock, which occupies a smaller area. Mature Fraser firs have been killed on mountain tops in the southern Appalachians. Seedlings grow well, but they are expected to die, too, when larger.

In the West. Several California oaks and related species are threatened by sudden oak death or the goldspotted oak borer. The most severe effects have been to tanoaks along the coast, from Big Sur to Eureka. Coast live oak, black oak, and other characteristic species are also

at risk. While sudden oak death's spread is limited by climate, the goldspotted oak borer probably can spread throughout the state. Conifer species have also suffered severe damage. Western white pines have been largely eliminated from the heart of the species' range in Idaho. High-elevation five-needle pines in many mountain ranges have either died from, or are threatened by, a combination of non-native white pine blister rust and expanding populations of native mountain pine beetles, fueled by climate change. Monterey and Torrey pines along the California coast are struggling against pine pitch canker. Port-Orford cedar has disappeared from much of its range at lower elevations.

They Keep Coming: Non-Native Forest Pests Introduced to the United States, 2003-2013		
On the mainland:		
Since 2003, at least 19 species of bark- and wood-boring insects have been reported for the first time, including:		
	redbay ambrosia beetle, vector of laurel wilt disease	goldspotted oak borer
	walnut twig beetle, vector of thousand cankers disease	soapberry borer
Other new tree-killing pests include:		
	polyphagous shot hole borer	red palm weevil
	Red palm mite	TPPD phytoplasma virus on palms
	South American palm weevil	
On Pacific islands:		
	'ohi'a rust	cycad scale
	cycad blue butterfly	Erythrina gall wasp

On Pacific islands. The unique forests of the Pacific islands face severe threats. Cycad forests on Guam already have been depleted by two non-native pests. On the Hawaiian Islands, the wiliwili tree, native to dry forests, was substantially reduced by an introduced gall wasp; biocontrol appears promising. The threat to the islands' most widespread tree, the 'ohi'a, is most worrying. A pathogen that attacks its close relatives exists throughout the islands. It has not yet killed many 'ohi'a, but it could better adapt to the new host, or a more virulent strain could be introduced. 'ohi'a; courtesy of

The Nature Conservancy of
Hawai'i



For descriptions of the individual pests and the trees they damage, visit www.dontmovefirewood.org/gallery.

What Can We Do?

Prevent pests' introduction and spread. *Secure the most important pathways by which new introductions enter the United States.* Such introductions are occurring at approximately two new pests each year. The principal pathways are imports of living plants and of untreated wood, usually as crates or pallets, sometimes as decorative items.

Secure the pathways by which pests are spread rapidly from one part of the country to another. Key pathways are interstate trade in living plants (sudden oak death, hemlock woolly adelgid); movement of firewood (emerald ash borer, goldspotted oak borer); and, in special cases, transport of untreated wood used by woodworkers and sawmills (laurel wilt, thousand cankers disease).

Improve tools to find and monitor pests *Research, develop, and apply new methods to detect forest pests quickly.* Technology lags behind the need, especially for tools that fit the biology and behavior of specific insects and pathogens.

Reverse pest damage *Breed resistance into trees.* Programs are under way for chestnut, elm, butternut, walnut, beech, hemlock, redbay, tanoak, ash, and high-elevation five-needle pines in the West. They all need more support.

Find biocontrol agents to reduce pest damage. Biocontrol programs exist to save ash trees from the emerald ash borer, to reduce hemlock losses due to the hemlock woolly adelgid, and to limit walnut mortality by the walnut twig beetle/thousand cankers disease.

Report pests *Learn pest symptoms, inspect trees in your neighborhood, and report pests.* See <http://healthytreeshealthycities.org> for information.