

Can ‘sentinel trees’ warn of devastating pests?

By planting groves of exotic species, nations hope to identify potential insect invaders

By **Gabriel Popkin**

It's become an all-too-common tale: An introduced insect takes hold in a new home and then spreads, wreaking havoc with ecosystems and economies. Take, for instance, the emerald ash borer, an Asian beetle first spotted in North America in 2002; researchers estimate it has killed hundreds of millions of ash trees and caused more than \$10 billion in damage.

Now, in a bid to prevent such catastrophes—and get an early warning of which exotic pests are likely to cause trouble—researchers from the United States, Europe, and China are trying a new approach: planting “sentinel trees” from their own regions in distant nations, and then observing which insects attack. The findings should help authorities more quickly recognize and

coronavirus pandemic doesn't interfere, researchers will plant the first sentinel grove of Asian trees in the United States.

A team led by entomologist Alain Roques of France's National Institute for Agriculture, Food, and Environment pioneered the approach between 2007 and 2011, when it planted seven tree species in Fuyang and near Beijing in China. By 2015, the researchers had identified more than 100 kinds of insects that had sampled the trees. They considered five species to be dangerous, and they took one—a bagworm moth—back to Europe to study its appetite for broad-leaved trees. That study, conducted under quarantine, showed the moth can destroy numerous trees, Roques reported in January at a U.S. Department of Agriculture conference in Annapolis, Maryland.

Hulcr became a convert after colleagues

additional plantations, which hold pines, oaks, and citrus trees, in Yunnan and Shandong provinces, and plans a fourth in Liaoning province.

So far, Hulcr's team has detected eight insect species of concern, which the researchers are now rearing and studying. Such studies could alert authorities to look for the pests, some of which were unknown to science, and lead to better monitoring traps and control measures.

Establishing sentinel orchards in a foreign nation can be fraught, Roques says. A Chinese farmer destroyed one of his plantings after seeing insect damage, not realizing the attacks were by design. He lost access to other potential sites after collaborators balked, fearing his trees would also bring European pests to Asia.

Funding agencies are ramping up support for sentinel groves. Europe's new project, called Holistic Management of Emerging Forest Pests and Diseases, is expected to run through 2024. And the U.S. Forest Service (USFS) is funding several projects, including one led by Ohio State University, Columbus, plant pathologist Enrico Bonello that, in April, is scheduled to plant the first sentinel trees from Asia and Europe—including beeches, hollies, maples, and pines—in Ohio and New Hampshire. Collaborators have already planted North American and Asian trees in Sweden and Italy.

It could take years to know whether the sentinels provide useful intelligence. Some insects won't attack young trees, for instance, so researchers will have to wait to see what the mature trees attract. And some trees become stressed and more vulnerable to insects when growing outside their native range, potentially making observations less relevant to predicting the impacts of invasions.

Governments, meanwhile, are still figuring out how they might incorporate any findings into biosecurity policies and practical actions. “Science and regulation are disjoint a lot of times,” Roques says. But Elizabeth Lebow, who directs invasive species programs for USFS's international office, believes new sentinel trees are “a really smart approach ... [to] informing our early detection efforts.” ■

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Sentinel trees could help prevent the spread of exotic insects, such as the emerald ash borer of Asia.

snuff out threatening introduced insects if they show up in the trees' native countries. Sentinel trees are “the new frontier” in fighting forest pests, says entomologist Jiri Hulcr at the University of Florida.

Already, groves of North American and European trees planted in China have enabled scientists to identify and start to study more than a dozen insects of concern. In Europe, 23 nations have launched a €5 million project that will, among other activities, establish sentinel nurseries in North America, Asia, and South Africa—and enable researchers to plant trees from those areas in Europe. And next month, if the

in China discovered a beetle demolishing American sweetgum trees that had been planted near Shanghai. Sweetgum is an ecologically and economically important species in the southeastern United States. If the beetle, which he and his colleagues named the sweetgum inscriber, gained a foothold in North America, it could pose a serious threat, they reported in 2017.

The discovery prompted China to ban imports of the tree, to avoid further damage. And it spurred Hulcr in 2018 to plant his first sentinel grove of North American trees in China's Fujian province. Hulcr and colleagues in China has since established two

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