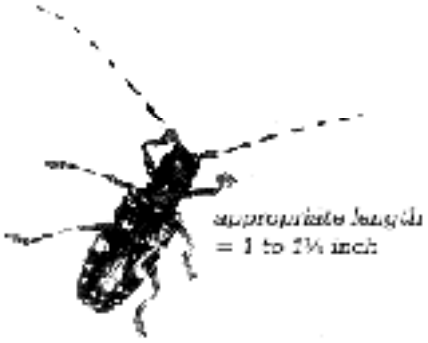
NEW ACOUSTIC DETECTOR HELPS LOCATE ASIAN LONGHORNED BEETLES

It's a scene straight out of a Tom Clancy novel: Chicago and New York City officials peering at wrist-band displays, waiting for signs (actually sounds), of dangerous fugitives in the street trees. The fugitives—Asian longhorned beetles that can kill even healthy hardwood trees—are real, and so is a new technology that can detect these voracious wood borers "en bite."

The beetle detector—a portable device that can hear the sounds of beetles chewing—is the brainchild of two groups of scientists: entomologists at North Central and acoustic specialists at the Department of Energy's Oak Ridge National Laboratory in Tennessee. "We needed a way to detect larvae [an early wormlike stage] in trees or in wooden packing materials, long before they're obvious to the eye," said Therese Poland, research entomologist with NC's Forest Insects unit in East Lansing.

Eavesdropping was the Answer

Knowing that wood borers make a chewing noise when carving out their galleries (feeding tunnels), NC contacted Cyrus Smith and his group at Oak Ridge's Instrumentation and Control Division. Smith's team had created many kinds of acoustic detectors, but they'd never been asked to build a bug for bugs. "By pairing our biological knowledge with their instrumentation skill," said NC's project leader Bob Haack, "we demonstrated how agencies can work together to protect natural resources."



▲ Asian longhorned beetle.

NC staff took four species of native wood borers down to Tennessee so analysts could record their munching. After several weeks of listening, they identified a sound pattern common to wood borers. The beetle detector compares this pattern to sounds from an infested tree, looking for a match.

To test the detector, NC and Oak Ridge staff recorded Asian longhorned beetles at the Northeastern Research Station's quarantine facility in Ansonia, Connecticut. Their next stop was China, where they recorded larvae feeding in live trees in their native habitat. (Korea is their other home ground.)

They counted how many insects were there, how large they were, and how far from the sensor they were. Differences among tree species were also noted. "Wood cell structure and density differ among tree species, so sound propagation will vary from tree to tree," Poland said.

"We expect the detector will work best in living trees where the larvae are most active and in crates and pallets made from green [moist] lumber," Haack said. In drier materials, larval development and beetle chewing slow to a crawl, meaning fast scans can miss the occasional bite.

To detect beetles in drier wood, Haack is thinking about another device: a snooping nose. "If we can build a sensor for sound, we may be able to build one that sniffs out insect frass (a mixture of boring dust and feces) or other chemical cues issuing from a newly opened packing crate," Haack said. "Either way, we hope to stop the beetles long before they leave the dock."

◀ Therese Poland testing the acoustic beetle detector in China.