

A disease complex involving beetles, their associated fungi, and other pathogens is causing widespread damage to trees in riparian ecosystems throughout southern California. Infestations are rapidly colonizing new watersheds and have shown the capacity to spread quickly and cause severe damage. Infestations already threaten least Bell's vireo recovery, and southwestern willow flycatcher and yellow-billed cuckoo are also susceptible.

#### Disease Complex:

Tree damage is caused by the combination of shot hole borers (ambrosia beetles) and the fungi they use as their food source. Two species of shot hole borers have been identified to date, the polyphagous shot hole borer (*Euwallacea* sp. 1) and Kurushio shot hole borer (*Euwallacea* sp. 5). The shot hole borers create galleries in trees and inoculate the galleries with fungal spores. *Fusarium* sp. is considered the primary fungal associate, but other fungi may be inoculated as well. *Fusarium* causes significant damage to trees, and the galleries open up trees to attack from other pathogens that may be even more damaging than *Fusarium*. As of fall 2015, the complex is known to reproduce successfully in 38 tree species, including 13 natives. The beetles attack 304 tree species, and the fungus infects 138 species.

#### History:

Unidentified shot hole borers were identified in the Whittier Narrows in 2003 but did not cause significant damage. An outbreak of unidentified shot hole borers caused significant damage to boxelders in Long Beach in 2010. The polyphagous shot hole borer species was not described as a unique species until 2012, when they were found in avocado in Los Angeles County. The disease complex has since been identified in several avocado groves and urban areas, parks with oak woodlands, and riparian systems. The most damaging infestations have been in Huntington Botanical Gardens, UC Irvine, Orange County Parks, and the Tijuana River.

#### Distribution:

The native range of the polyphagous shot hole borer is southeast Asia, and the initial infestations are thought to have come to California from nursery stock. It appears that the disease complex was restricted to the Los Angeles basin until 2012, but it has spread as far south as the Tijuana River and as far north as Ventura County with potential infestations in San Luis Obispo and Santa Cruz counties. To date, distribution data have been generated from traps with lures associated with avocado groves and haphazard observations in urban, parkland, and riparian areas generated during response to tree damage.

#### Damage:

The disease complex was not identified in native riparian ecosystems until summer 2015 when it was identified in the Tijuana River. By March 2016, an estimated 65-82% of willows (140,000) in the Tijuana River outbreak now show damage. Since the observation in the Tijuana River, the disease complex has been identified in the San Luis Rey River (San Diego County), San Diego Creek (Orange County), and Santa Ana River (Riverside County). Each of these riparian areas is within or near significant populations of the least Bell's vireo.

### Control Options:

Funding for research has come primarily from the avocado industry, and control techniques have focused on pesticide application (both insecticide and fungicide). Because the beetles and fungi are protected within galleries in trees, pesticide application is difficult, and treatments have shown limited effectiveness. Regardless, these treatments are unlikely to be appropriate for riparian ecosystems. Control within urban areas has focused on trimming infected limbs or removing entire trees to allay safety concerns. UC Riverside researchers have begun trials to assess the effectiveness of native bacteria to control *Fusarium* and a native fungus to control the beetles. In addition, they have identified several natural enemies of the polyphagous shot hole borer in its native range. Although most of these natural enemies are generalists and, therefore, inappropriate for biocontrol, researchers have identified a parasitoid wasp that may be specialized enough to consider for release in California. None of these efforts is likely to be ready for application in less than 2 years.

### Current Strategy:

At this time, the best control strategy in riparian ecosystems is early identification of outbreaks followed by removal and chipping or grinding of infected trees. Chipping and grinding effectively suppress shot hole borers. If possible, chipped material should be covered in tarps and solarized from 6 weeks to 6 months depending on weather conditions. It is also important to avoid spreading infected material. For example, do not transport infected fire wood or landscaping waste.

### Need:

We are requesting that land managers familiarize themselves with the identification and management tools in the attachments and links and work with researchers, local jurisdictions, and wildlife agencies to react to infestations where they are found.

### Internet Resources:

<http://eskalenlab.ucr.edu/avocado.html>

<http://ucanr.edu/sites/pshb/>

[http://ucanr.edu/sites/socaloakpests/Polyphagous\\_Shot\\_Hole\\_Borer/](http://ucanr.edu/sites/socaloakpests/Polyphagous_Shot_Hole_Borer/)