Goldspotted Oak Borer

Preventing the spread and caring for California's iconic Oak trees

RESOURCE CONSERVATION DISTRICT
Greater San Diego County

Overview of the Goldspotted Oak Borer (GSOB)

Goldspotted Oak Borer (GSOB)), *Agrilus auroguttatus* (Coleoptera: Buprestidae), is a flatheaded borer beetle in California that poses a significant threat to oak tree species such as coast live oak (*Quercus agrifolia*), canyon live oak (*Q. chrysolepis*), and California black oak (*Q.kelloggii*). It is known to attack Englemann oak (*Q. engelmannii*) but not kill this species. The pest is native to southeastern Arizona, where it is found in oak woodlands. Experts believe this non-native oak pest was introduced into San Diego County from Arizona and from San Diego County into other locations by this same method.

GSOB was first collected and identified in California in 2004 in San Diego County but was not linked to extensive oak mortality until 2008. Isolated areas of infestation have been confirmed in Riverside, Orange, Los Angeles, and San Bernardino Counties in Southern California. As of 2010, GSOB has killed an estimated 21,500 trees covering 1,893 square miles in San Diego County in forests, parks, and residential landscapes.

It is contributing to the on-going oak tree mortality occurring on federal, state, private, and local Native American lands in many areas of San Diego County. This widespread oak mortality can have severe implications to the environment and human safety. Due to the current and potential impacts to California oaks and communities, public and private organizations are working together in the research, education and outreach efforts related to GSOB management.

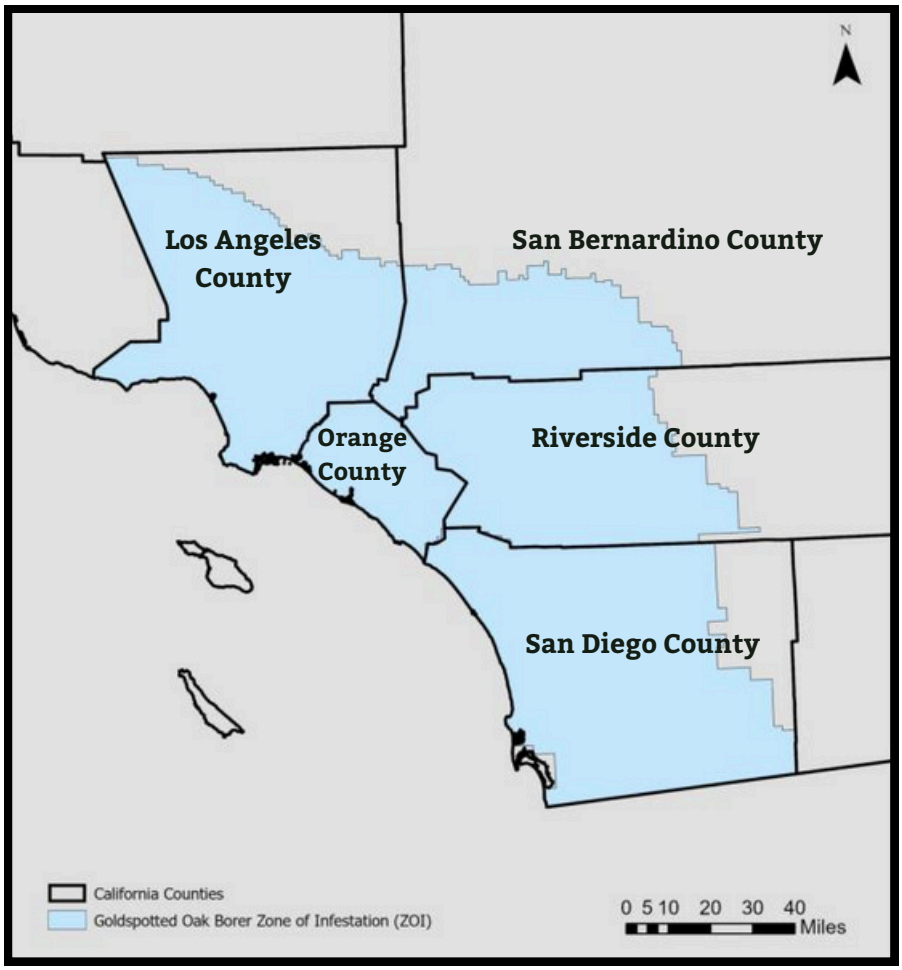

Figure 1. Corella, Kim. "GSOB Zone of Infestation in San Diego, Riverside, Orange, Los Angeles and San Bernardino Counties." UCNAR. 2020. https://ucanr.edu/sites/gsobinfo/About_GSOB/Distribution/.

Lifecycle of GSOB

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Egg are laid in the crevices of the bark. (Jun-Sep)						■	■	■	■			
Larvae bore under the bark of the tree and feed. (Early summer-Oct)						■	■	■	■	■		
Prepupa in hairpin configuration in pupal cell. (Oct-Jun)	■	■	■	■	■	■				■	■	■
Prepupa constrict in length and develop into pupa. (April-Jul)				■	■	■	■					
Adult emergence. (Mid May-Sep)					■	■	■	■	■			
D-Shape exit holes. (Mid May-Sep)					■	■	■	■	■			

Photo by GSOB Ventura County Training Webinar 2024.

Photo by GSOB Ventura County Training Webinar 2024.

Photo by Tom W. Coleman.

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GSOB is believed to have a single generation each year. In its current introduced range in Southern California, adult females lay eggs on host trees primarily from June through September.

First-instar larvae hatch from eggs in about two weeks and bore through the outer bark to feed deeper in the tree in the phloem and outer xylem layers. Larvae complete three more instars before maturing and burrowing back to the outer phloem. These mature larvae (or prepupae) occur under and in the bark year-round but are most easily located in the outer phloem of severely infested trees. They form pupal cells near the bark surface and fold into a hairpin configuration. They may remain in this nonfeeding stage from October to as late as June of the following year.

Beginning in April, prepupae begin to constrict in length in the pupal cell and develop into pupae. GSOB pupae may be observed within the outer bark of infested trees from late April through July.
Adult emergence occurs from mid-May to September with peak flight activity occurring from late June to early July in Southern California. Following emergence, adults must feed on the foliage of host trees to survive and reach sexual maturity, which takes about two weeks.

Mating likely occurs on the foliage and twigs in the crown of the host trees. Adults generally live for several weeks in the field but have survived up to two months in a laboratory environment.

Identifying GSOB

The adult goldspotted oak borer (GSOB) *Agrilus auroguttatus* is a small, bullet-shaped beetle about 10mm (0.4 in.) long and has six golden yellow spots on its dark green forewings. Mature larvae are white, legless, slender and about 18mm (0.75 in.) long with two pincher-like spines at the tip of the abdomen. Larvae feed under the bark on the trunk and larger branches. Larval feeding kills patches and strips of cambium tissue beneath the bark which causes dark staining and sap flow. The larvae pupate in the outer bark and leave D-shaped exit holes about 1/8 in. wide when they emerge. Pupae are found in the outer bark and resemble adults, but are commonly white in color. Visible evidence on three species of oak trees is common in San Diego County. When their larvae create feeding galleries underneath the surface of the bark, GSOB attacks may be recognized by the following evidence:

- Red or black staining in dime-sized to half foot sections
- Blistering and oozing on the surface of the tree
- Crown thinning
- Twig and branch die-back
- Premature leaf loss

Evidence of injury can also include chipped outer bark from woodpeckers feeding on the larvae and small D-Shaped exit holes where the gold spotted beetles pupate and emerge from the tree. Impact varies between three oak species and can consist of gray or brown coloring in the crown of the tree and thinning of the foliage.

Figure 2. Visible signs of D shape exit holes on an oak tree. Photo by RCDGSDC.

Figure 3. Bark staining and bleeding resulting from GSOB larval feeding. Photos by Tom W. Coleman.

Figure 4. Inner bark exposed to woodpecker foraging is first red but later darkens. Photo by Tom W. Coleman

Figure 5. Removal of bark exposes the meandering larval galleries filled with dark frass. Photo by Tom W. Coleman

Figure 6. Thinning of coast live oak crown. Photo by Tom W. Coleman.

Figure 7. Adult GSOB and chewing damage on leaf. Photo by Tom W. Coleman..

Stop the Spread!

How to identify GSOB and take action to stop the spread

Step 1: Don't move firewood

- GSOB travels on firewood, the most important thing you can do to stop the spread is to burn it where you buy it!

Step 2: Pest Identification

- Learn how to identify signs and symptoms of GSOB infestation. You can report infestations on gsob.org's infestation map!

Step 3: Monitor and assess GSOB infestation and tree damage

- Evaluate your oak trees and look for signs of GSOB infestation annually. Adult beetles emerging from your tree leave D-shaped exit holes in the bark..

Step 4: Establish your management plan

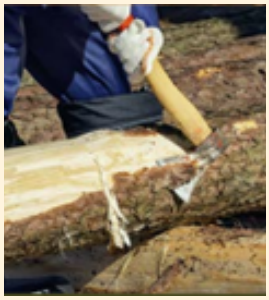
- Determine your course of action for protecting high-value oak trees that are lightly infested or not yet infested.

- Manage infested wood properly to decrease the risk of GSOB through firewood.

Report GSOB today! You can track the spread and report infestations on gsob.org
Scan the QR below to participate.

How to Manage an Infestation

Once you have determined a GSOB infestation, how do you treat infested wood?

Method	Pros	Cons	
Seasoning Uncontained Wood	• No cost or labor involved. • Wood can be used as firewood after 2 years.	• GSOB can emerge from uncontained wood and infest neighboring trees. • Splitting dried wood is labor intensive. • Piled wood can be fire hazard.	
Seasoning with Aluminum Screening	• Inexpensive method to contain and stop emerging GSOB from spreading. • Required equipment is easy to find; use fine mesh aluminum window screening. • Wood will not mold; wood can be used after 2 years.	• Screening contains GSOB but does not kill it; without proper sealing there's a risk of beetles escaping. • Metal may be difficult to seal properly • Metal may be susceptible to punctures by falling debris like pine cones and branches.	
Seasoning with Tarping	• Inexpensive method to contain and stop emerging GSOB from spreading. • No special equipment needed; use UV-resistant 6mil plastic tarps. • Wood can be used after 2 years.	• Tarp contains GSOB but does not kill it; regular maintenance and proper sealing is required to prevent beetles from, escaping. • Wind can tear or lift buried edges. • Non-UV tarp will degrade in sun. • Wood may become moldy.	
Grinding and Chipping	• GSOB won't survive grinding to <3 inches. • Chips can be used after 2 years.	• Expensive specialized equipment and handling services required. • Chips can contribute to fire hazards; check with local fire agency for guidance.	
Debarking	• Debarked wood (stripped all the way back to the sapwood) is free of GSOB and can be safely sold and/or moved long distance.	• Labor intensive; can be difficult to accomplish on "green" wood from recently killed trees. • Bark still harbors GSOB and has to be treated (seasoned, chipped, tarped, or screen) to prevent spread.	

Coming Together to Combat GSOB

Our RCD team helped support two GSOB management and research projects.
We supported with research and a capacity building demonstration project in collaboration with La Jolla Band of Luiseño Indians. This project has many facets including falling and processing dead oak trees, planning, researching new treatments, and workforce development. Joelene Tamm, a Native American researcher, is collecting data to observe how cultural burning can be used as a treatment tool to combat GSOB to save heritage oak trees.

We continue to support the Oak Grove GSOB Project in collaboration with researcher Dr. Tom Scott of University of California Agriculture and Natural Resources (UCANR) and Green Tree Forest Service arborist who is a state-licensed and county-registered pesticide applicator. This demonstration project supports annual monitoring and treatment of hundreds of trees as part of a 10-year research project.

In 2024, the RCDGSDC offered a GSOB treatment assistance program to provide financial assistance to homeowners that voluntarily participated in tracking, monitoring, and treatment of GSOB infested oak trees in San Diego County with the Carbaryl Basal Treatment method.

Check out the instructional video guide, “Fighting the Goldspotted Oak Borer” featuring Dr. Tom Scott and certified arborist Bret Hutchinson.

Resources

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