



Goldspotted Oak Borer

- Research
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Goldspotted Oak Borer

(February 2012)

Since 2002, a non-native invasive beetle called the goldspotted oak borer (GSOB - *Agrilus auroguttatus*) has killed approximately 80,000 oak trees in San Diego County. GSOB was previously known to exist only in central Mexico, Guatemala, and southeastern Arizona. Believed to have been transported into the San Diego area on firewood from Arizona, GSOB continues to spread within the county causing significant tree losses across all ownerships: federal, state, county, and city public lands; tribal lands; public parks and campgrounds; along roads and highways; private campgrounds; ranches; and rural and urban residences.

GSOB has caused significant economic, ecological, cultural, and aesthetic losses to the region. To date, an estimated \$8 million in public and private funds has been spent or lost on GSOB mitigation activities, including dead tree removals and infested wood disposal; closure of parks and campgrounds (due to hazardous dead trees); developing and supporting public outreach and education; and engaging government agencies for response and assistance. While oak trees in San Diego County occupy less than 10% of the area, a single or group of trees killed results in ecological loss in terms of shading, acorn production, shelter, roosting, and other habitat values. Additionally, many large oaks that have died from GSOB are well over 200 years old and represent significant cultural, aesthetic, and property value losses.

Because GSOB is a non-native pest, native trees exhibit no natural defense mechanisms to successfully fight off an attack. Susceptible oak species (coast live oak, California black oak, and canyon live oak) are found throughout much of California and southern Oregon, causing concern among the scientific community about the potential for GSOB to spread into non-infested areas. Given that GSOB likely was introduced to San Diego County via firewood, it is possible that infested wood moved to a non-infested area could start a new outbreak.

The key management strategy for preventing GSOB spread is to stop the movement of infested oak firewood to non-infested areas. GSOB larvae can live underneath the bark of dead oaks for over a year before exiting the wood as adults. With oak firewood highly desirable for home heating and campfires, and obtainable at low costs, the risk that GSOB will be introduced into new local or distant areas via firewood movement is high.

Background: The Response to GSOB

Currently, there are no existing laws or regulations at the federal, state, or local levels that prevent the movement of GSOB-infested wood or wood from an area known to have GSOB. Additionally, the firewood industry has very little regulatory oversight, and operators vary in size from large commercial wood yards to individuals.



University of California
Agriculture and Natural Resources

The federal New Pest Advisory Group (NPAG) of the USDA Animal and Plant Health Inspection Service (APHIS) classified GSOB as a “non-reportable/non-actionable” pest because it is native to southeastern Arizona. At the California state level, a quarantine must be initiated by request from a county agricultural commissioner to the California Department of Food and Agriculture (CDFA). To date, no county commissioners have made such a request, but rather they have expressed concern about a potential quarantine’s effectiveness, cost, logistical difficulties, and potential to draw away existing resources currently combating other invasive pests that threaten agricultural commodities. The California State Board of Forestry and Fire Protection (BOF) is monitoring the GSOB issue closely. In general, the BOF does not regulate oak firewood removal or movement. At the local level in San Diego County, federal, state, county, and city officials, working with the University of California, established a GSOB “Steering Committee,” for a comprehensive cooperative approach to learning more about this invasive pest as well as how to confine, control, and eradicate it.

Funding and staff for current GSOB-related efforts has come from multiple sources. An American Recovery and Reinvestment Act grant will continue to fund some of the GSOB work being done by UC Berkeley and UC Cooperative Extension until mid-2012. USDA Forest Service - Forest Health Protection and the Cleveland National Forest have redirected resources and personnel to work on GSOB, as have CAL FIRE and other federal, state, and local agencies.

Potential Economic Impacts of GSOB in California

The cost of dead and hazardous tree removals is only one aspect of GSOB’s potential economic impact. Large majestic oaks (particularly susceptible) greatly add to property values in urban settings. As an example, correlating parcel data with oak tree data in Los Angeles County (where an oak tree protection ordinance is in place and oaks are the signature tree for many communities) to assess the potential magnitude of costs should GSOB spread, suggests that tree removal costs could range from \$27.1 million to \$135.5 million and that property values could decline from \$150 million to nearly \$1 billion dollars.

Los Angeles County Example

# of SFD* parcels w/oaks	# of SFD* oak trees at risk	# of street trees at risk	Removal costs with 10% tree mortality	Removal costs with 50% tree mortality	Range of potential property value loss 10%-50% mortality
279,088	45,500	90,000	\$27.1M	\$135.5M	\$150M to > \$1B

*SFD=Single Family Dwelling

Nearly all California counties have oak resources. Should GSOB spread beyond San Diego County to the rest of the state, the cost and losses could be staggering.

How to Support GSOB Prevention and Response Efforts

Funding, partnerships, networking, research, educational outreach, and strategic regulation are key components of oak protection. Here are some steps to consider:

- **Participate in a joint GSOB legislative hearing with other legislators and representatives from local, state, and federal agencies to discuss how best to stop the spread of GSOB.**
- **Investigate potential regulation of the firewood industry to reduce the risk of invasive species spread, including GSOB.**
- **Support National Firewood Task Force and California Firewood Task Force (www.firewood.ca.gov) efforts to prevent the spread of invasive species via firewood movement.**
- **Support research funding for GSOB prevention, management, and control.**
- **Help educate your constituents and peers about the dangers of GSOB and other invasive pests and pathogens, including the threat posed to local, state, and national parks as well as forests and communities.**
- **Prepare for a statewide GSOB Task Force should it spread beyond San Diego County and threaten the rest of California.**

For more information, contact:

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FOREST PEST MANAGEMENT POLICY

5080.1.1

Pursuant to Public Resources Code 4715, the department, in accordance with policy established by the board, may enter into agreements with any owner and with any agency of government, including the federal government, for the purpose of controlling or eradicating forest insects or plant diseases damaging or threatening destruction to timber or forest growth, and it may make expenditures for that purpose.

Policy for Goldspotted Oak Borer

Since 2002, a non-native invasive beetle called the goldspotted oak borer (GSOB - *Agrilus auroguttatus*) has killed approximately 80,000 oak trees in San Diego County.

GSOB has caused significant economic, ecological, cultural, and aesthetic losses to the region due to tree mortality. To date, public and private costs are estimated at \$8 million for GSOB mitigation activities and lost value.

Because GSOB is a non-native pest, native trees exhibit limited natural defense mechanisms to successfully fight off an attack and a diverse natural enemy complex is lacking for this species. Susceptible oak species (coast live oak, California black oak, and canyon live oak) are found throughout much of California.

The key management strategy for preventing GSOB spread is to stop the movement of infested oak firewood to non-infested areas.

Should GSOB continue to spread, tree removal costs could range from \$27.1 million to \$135.5 million and related property values could decline by \$150 million to nearly \$1 billion dollars.

Board Policy based on CA Forest Pest Council Recommendations

1. Conduct a GSOB hearing with legislators and representatives from local, State, and Federal agencies to discuss how best to stop the spread of GSOB.
Recommendation: Board conduct hearing, inviting legislators, particularly those from San Diego, to review Policy statement.
2. Investigate potential regulation of firewood movement to reduce the risk of invasive species spread, including GSOB.
3. Support National Firewood Task Force and California Firewood Task Force (www.firewood.ca.gov) efforts to prevent the spread of invasive species via firewood movement.
4. Support funding for GSOB prevention, management, and research.
5. Support outreach about the dangers of GSOB and other invasive pests, including the threat posed to local, state, and national parks as well as forests and communities.
6. Support establishment of a statewide GSOB Task Force should GSOB spread beyond San Diego County and threaten forest resources in the rest of California.

Best Management Practices

Cultural Control

- Transporting infested firewood can potentially introduce GSOB into additional areas. Firewood and cut wood from infested oak trees should **not** be moved from an infested area until the wood has seasoned for at least two years.
- Covering cut oak wood with clear plastic tarpaulins does **not** kill developing beetles, but adult emergence can be contained if soil covers the edges of the tarp and logs are left covered from May to October. Use UV plastic and double layer plastic to prevent tearing.
- Place cut infested material away from living oaks to reduce the threat of additional infestation. Removing severely infested trees and properly managing the wood can potentially reduce localized populations and help protect high-value trees.
- Grinding wood may be the best method to ensure beetles will not survive in infested wood. All wood should be ground to < 3 inches in particle size to minimize the spread and population growth of GSOB.
- Debarking wood can remove GSOB populations from infested cut wood. Debarking should remove > 95 percent of the bark with no remaining bark and phloem thicker than 1 inch on the sapwood surface. The removed bark should not be moved because GSOB populations can persist in the bark shavings.
- Mulching, soil aerations, and fertilizing may increase oak health and delay tree mortality from GSOB. However, no research has been conducted to confirm this recommendation.

Prevention and Suppression Using Pesticides

Only state licensed and county registered pesticide applicators should be contacted for cover/barrier and systemic insecticide applications. Over-the-counter products may not contain adequate levels of insecticide to impact GSOB populations, and inappropriately applied pesticides can have negative health and environmental effects. Strictly follow insecticide labels for treatment application. Treating trees with an insecticide does not guarantee protection.

Cover/Barrier Spray Insecticides:

- Cover/barrier sprays do not inflict wounds to trees and the insecticide is effective immediately. Therefore, these treatments may be the best option to reduce additional attacks from GSOB on high-value trees. Trees infested with GSOB and in severe decline should be removed rather than sprayed. Infested wood must be disposed of properly to ensure that it does not serve as a source of beetles and that it is not moved to uninfested areas.
- Insecticide sprays should be applied to the main stem, larger branches (> 5 inch diameter), and foliage once a year. A pyrethroid (cyfluthrin, permethrin, or bifenthrin) or a carbaryl insecticide may provide adequate protection of host trees for a single season. Conduct cover/barrier sprays during the spring (early to mid-May) in southern California to target adult flight activity, which lasts from late May until late October.

Systemic Insecticides:

- Systemic insecticides should only be used in oaks that are uninfested or lightly infested. Stem injections may not provide adequate suppression in low-vigor trees because the compound will not be adequately transported throughout the tree.
- Systemics show decreased efficacy in infested trees with significant crown thinning and dieback (> 20 percent crown thinning and dieback). Trunk injections may cause minor wounding and injure trees with repeated applications. Systemic insecticides and whole-tree spraying can be used in unison to increase the likelihood of saving high-value trees.
- Imidacloprid is a systemic insecticide that can be trunk injected. Systemic treatments should be re-applied every year (additional research is needed to confirm this). Stem injections should be applied from winter to early spring when precipitation is frequent. Watering trees after injection may improve translocation of the insecticide.

**This Policy shall become part of Department Issuance Handbook 5000
Adopted April 4, 2012 in Sacramento**

In addition, insect and/or disease infestations are declared by law to be a public nuisance that should be abated. The law provides that the Director or his/her agents may go upon private property to conduct abatement work when such work is determined to be necessary for the welfare of adjacent landowners. The law respects the privilege of a single landowner to allow an infestation or infection to exist unabated if it does not menace the forest values of his/her neighbors. The law also requires precise delineation of a zone boundary declared by the Director and approved by the Board of Forestry and Fire Protection before the zone can come into existence.

It is therefore further directed that the Director will investigate the appropriateness and necessity of a Zone of Infestation pursuant to Public Resources Code, and report the findings to the Board no later than September of 2012:

4716. (a) Whenever the director determines that there exists an area that is infested or infected with insect pests or plant diseases injurious to timber or forest growth and that the infestation or infection is of such a character as to be a menace to the timber or timberlands of adjacent owners, the director, with the approval of the board, may declare the existence of a zone of infestation or infection, and describe and fix its boundaries.

(b) If the director declares the existence of a zone of infestation or infection pursuant to subdivision (a), the department or its agents may go upon state and private lands within the zone of infestation or infection and shall cause the infestation or infection to be eradicated or controlled in a manner that is approved by the board.

(c) (1) Within a zone of infestation or infection, the department may remove live vegetation directly adjacent to dead or dying vegetation that is substantially at risk of infestation or infection.

(2) The department may also remove soil that harbors or could reasonably harbor insects or pathogens injurious to timber or forest growth, and that have the potential to facilitate the spread of insects or pathogens to live trees or could substantially increase the risk of subsequent infestations or infections.



Best Management Practices for Preventing Tree Mortality Caused by the Goldspotted Oak Borer January 2012

Please Note

Prevention and suppression methods are currently being developed for the goldspotted oak borer (GSOB), *Agrilus auroguttatus*. To limit the impact and spread of this new invasive insect, some management guidelines were adapted from similar *Agrilus* species that injure hardwoods. This document outlines current best management practices and knowledge for preventing tree mortality from GSOB.

Cultural Control

Transporting infested firewood can potentially introduce GSOB into additional areas. Firewood and cut wood from infested oak trees should **not** be removed from an infested area until the wood has seasoned for at least two years.

Covering cut oak wood with clear plastic tarpaulins does **not** kill developing beetles, but adult emergence can be contained if soil covers the edges of the tarp and logs are left covered from May to October. Use UV plastic or double layer plastic to prevent tearing.

Place recently killed infested material away from living oaks to reduce the threat of infestation. This is a very localized control option, and may be only necessary for high-value trees. Removing severely infested trees and properly managing the wood can potentially reduce localized populations in a high-value setting.

Grinding wood may be the best method to ensure beetles will not survive in infested wood. All wood should be ground to < 3 inches in particle size to minimize the spread and population growth of GSOB.

Debarking wood can remove GSOB populations from infested cut wood. Debarking should remove > 95 percent of the bark with no remaining bark and phloem thicker than 1 inch on the sapwood surface. The removed bark should not be moved because GSOB populations can persist in the bark shavings.

Mulching, watering, soil aerations, and fertilizing oaks may increase oak health and delay tree mortality from GSOB. No research is available for this management activity.

Prevention and Suppression Using Pesticides

Only state licensed and county registered pesticide applicators should be contacted for cover/barrier and systemic insecticide applications. Over-the-counter products may not contain adequate levels of insecticide to potentially impact GSOB populations, and inappropriately applied pesticides can have negative health and environmental effects. Strictly follow insecticide labels for treatment application. Treating trees with an insecticide does not guarantee protection.

Cover/Barrier Spray Insecticides:

Cover/barrier sprays do not inflict wounds to trees and the insecticide is effective immediately. Therefore, these sprayed insecticides may be the best treatment to reduce additional attacks from GSOB in lower vigor, less healthy, or injured trees. Trees with GSOB that are in severe decline should probably be removed rather than sprayed. The infested wood must then be disposed of properly to ensure that it does not serve as a reservoir to produce additional beetles and that it is not moved to uninfested areas.

Spray high-value oaks completely on the main stem, larger branches (> 5 inch diameter), and foliage once a year. Spraying with a pyrethroid (cyfluthrin, permethrin, or bifenthrin) or a carbaryl insecticide may provide adequate protection of host trees for a single season. Conduct cover/barrier sprays during the spring (early May to mid-May) in southern California to coincide with adult flight activity, which lasts from late May until late October.

Systemic Insecticides:

Systemic insecticides should be used in oaks that are uninfested or lightly infested, and less applied as a prophylactic treatment. Stem injections may not provide adequate suppression in low-vigor trees because the compound will not be adequately transported throughout the tree.

Systemics show decreased efficacy in infested trees with significant crown thinning and dieback (> 20 percent crown thinning and dieback). Trunk injections may cause minor wounding and injure trees with repeated applications. Systemic insecticides and whole-tree spraying can be used in unison to potentially save high-value trees.

Imidacloprid is a systemic insecticide that can be trunk injected. Systemic treatments should be re-applied every year until additional research is collected. Stem injections should be applied from winter to early spring when precipitation is frequent in southern California. Watering trees after insecticide application may assist with translocating the insecticide compound.

For more information on GSOB, go to www.gsob.org or contact Kim Camilli, Forest Pest Specialist with CAL FIRE and Cal Poly San Luis Obispo, at (805) 550-8583 or email at kim.camilli@fire.ca.gov.

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Firewood and potential forest pests entering California in 2011

The sixteen agricultural border protection stations of the California Department of Food & Agriculture (CDFA; Map 1) inspect any firewood entering the state for presence or evidence of wood-inhabiting pests. Infested firewood is denied entry to the state and potential pests are collected for identification. In addition, the following details are recorded on every inspected load of firewood: quantity, species (if known), origin state and destination city. Following are some key points from the data on firewood and potential forest pest interceptions for calendar year 2011.

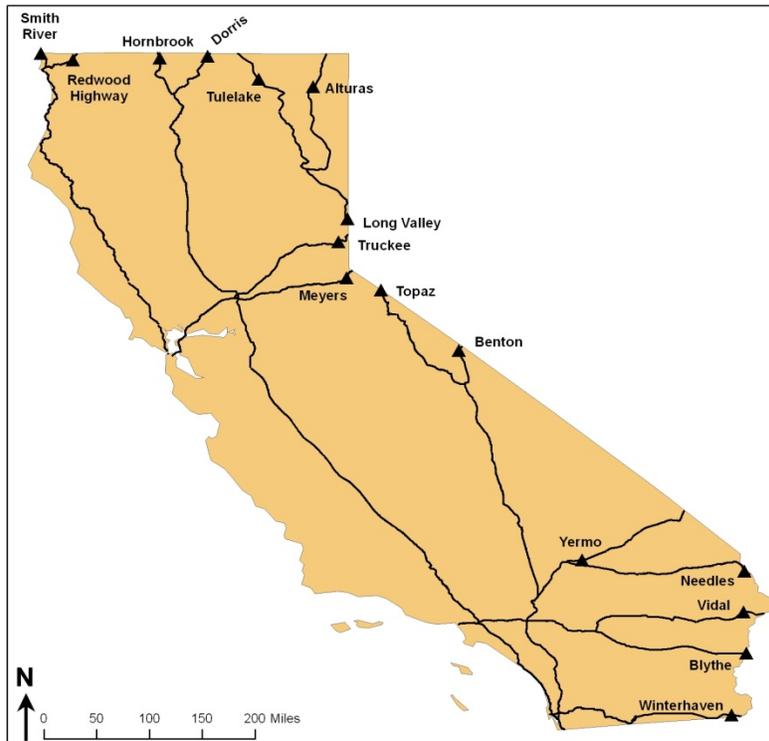
Firewood

- 🌲 Almost 23 million pounds (lbs) of firewood were recorded in 8,400 individual loads.
- 🌲 Top entry points by weight were Hornbrook (8.8 million lbs), Redwood Highway (5.4 million lbs), Alturas (1.9 million lbs), and Yermo (1.7 million lbs).
- 🌲 Almost 2/3 (63%) of the firewood by weight was in commercial vehicles, but these represented only 10% of the total number of individual loads.
- 🌲 Firewood came to California from 46 other states, Canada, and Mexico. Top firewood origins by weight were Oregon (13 million lbs), California (2.9 million lbs), Canada (2.7 million lbs), and Utah (1.2 million lbs).
- 🌲 Firewood was being taken to over 550 named destinations, the vast majority (500; 20 million lbs) in California. Most of the remainder was being taken to Reno, NV.
- 🌲 Calculated as straight-line distances between border stations and named destinations, firewood in commercial vehicles was expected to travel twice as far on average than wood in private vehicles (193 miles versus 78).
- 🌲 The average distance firewood was expected to travel varied widely between the border stations. Wood entering the state at Needles (268 miles), Hornbrook (192 miles), and Vidal (179 miles) traveled the furthest while wood entering at Winterhaven (8 miles) and Alturas (18 miles) tended to stay very local.

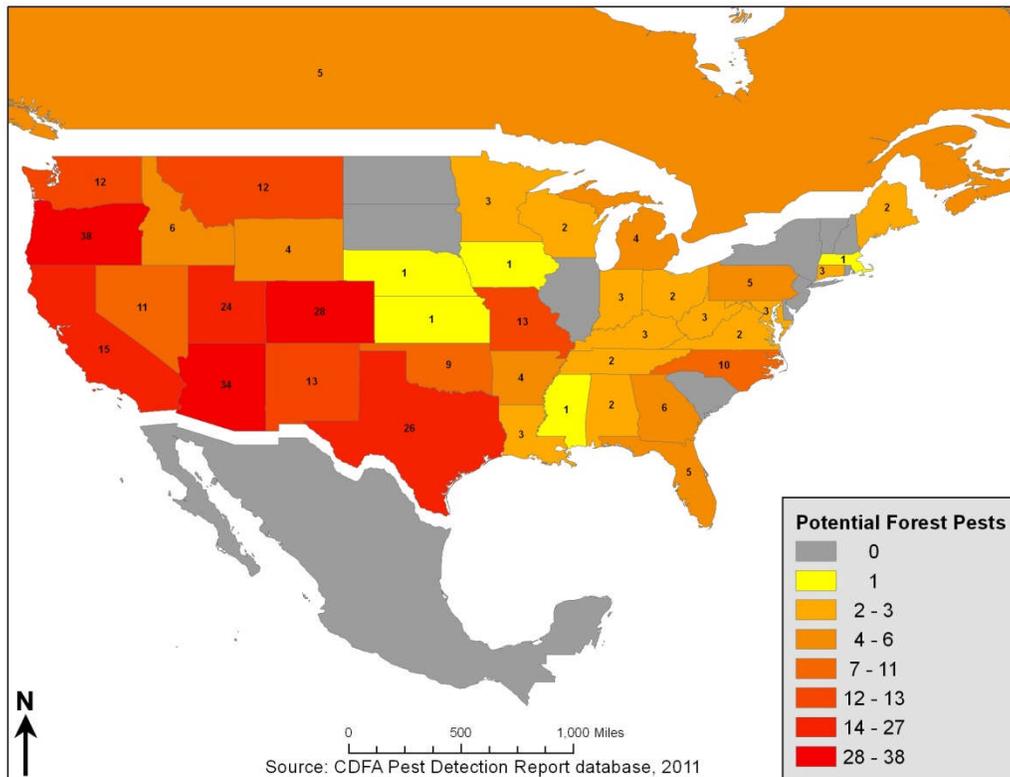
Potential Forest Pests

We defined potential forest pests as belonging to any of the following groups: wood-boring beetles (Cerambycidae and Buprestidae), bark beetles (Scolytinae), termites (Isoptera), Margarodidae (scale bugs), Lasiocampidae (tent caterpillars), Lymantridae (gypsy/tussock moths), Tortricidae (leafrollers/budworms), and Siricidae (wood wasps).

- 🌲 Border stations intercepted 337 potential forest pests in firewood in 2011. Over one-third of them (37%) were intercepted at the Needles station on westbound Interstate 40.
- 🌲 The great majority (93%) of the intercepted pests were beetles. Fortunately none of the major invasive exotic pests in the United States were intercepted in 2011; however, Emerald Ash Borer was intercepted in firewood from Michigan in 2010.
- 🌲 Potential forest pests came to California from 38 other states and Canada (Map 2). Top origins were Oregon (38 pests), Arizona (34 pests), Colorado (28 pests), and Texas (26 pests).
- 🌲 Over a quarter (26%) of the intercepted pests were in vehicles with CA license plates, bringing wood back to California from at least 19 other states.
- 🌲 Potential forest pests were going to over 120 named destinations, nearly all of them in California. Top destinations were the greater Los Angeles urban area (27 pests), the Sacramento urban area (25 pests), Yosemite National Park (20 pests), San Francisco (19 pests), the Riverside-San Bernardino urban area (14 pests), and Placerville (11 pests).



Map 1. Locations of CDFA border stations and the highways whose traffic they inspect.



Map 2. Origin states of potential forest pests intercepted in firewood in 2011.