



Individual Pest Risk Assessment

Goldspotted Oak Borer



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INTRODUCTION

Goldspotted oak borer (GSOB) *Agrilus coxalis*, was first detected in California (San Diego Co.) in 2004 during a trap survey for invasive tree pests. In 2008 this borer was linked to elevated levels of oak mortality ongoing in San Diego Co. since 2002. Its existence in CA may date back to as early as 1996, based on examinations of previously killed oaks. GSOB is native to Arizona and Mexico and was likely introduced into southern CA via infested oak firewood. It is a serious pest of coast live oak, *Quercus agrifolia*, canyon live oak, *Q. chrysolepis* and California black oak, *Q. kelloggii* in CA and has killed more than 20,000 trees across 620,000 acres.



Goldspotted oak borers.
Source: S. Blomquist

GSOB-killed oaks have only been found in San Diego Co. to date, however, it is expected that the area of infestation will continue to extend north beyond the county line and tree mortality will continue to increase due to adult flight from infested trees and new infestations initiated through beetles emerging from transported firewood.

Larvae are the injurious stage of the insect. They feed extensively at the interface of the phloem and xylem resulting in patches of dead cambium. Feeding sites may also serve as an infection pathway for pathogens or other pests. Tree mortality occurs after several years of continuous infestation. Mortality occurs in trees > 5" inches in diameter; however GSOB appears to preferentially attack older, mature trees. The main adult flight period occurs between late May and October and there is one generation per year.

The New Pest Advisory Group (NPAG) report (January 22, 2009) recommended that PPQ designate GSOB as non-reportable/non-actionable for the United States because it is native to Arizona and is established in southern California. The amended NPAG report (October 15, 2009) added GSOB to the FY10 exotic wood borer/bark beetle national survey manual and recommended that GSOB be referred to PPQ, Emergency and Domestic Programs. PPQ, Emergency and Domestic Programs concluded there was not a clear federal regulatory role and were therefore unable to address the potential spread of GSOB with firewood and other high risk articles within the State of California. They recommended state authorities to address intrastate movement as appropriate.

A GSOB Strategic Plan (September 2009) has been developed and contains information on management, survey and detection, regulatory and best management practices, research and technology development, restoration and sustainability, and outreach, education and technology transfer. A GSOB Steering Committee is in place in San Diego Co. and an incident action plan is being developed.

PEST RISK ASSESSMENT FOR THE GOLDSPOTTED OAK BORER

This document follows the Forest Service Pest Risk Assessment (Kliejunas et al. 2001) format and is intended to provide information regarding the current status of GSOB in California, its potential to spread to uninfested locales, and the consequences of establishment. The high, moderate or low risk values are based on available biological information and the subjective judgment of the authors.

1. Probability of pest establishment: HIGH risk

Breeding populations have been confirmed in San Diego County, California since 2008.

2. Spread potential: HIGH risk (very certain)

GSOB will spread naturally via adult flight and also artificially in infested oak firewood. The infestation is presumed to have initiated near the towns of Descanso, Guatay and Pine Valley where oak mortality was first detected via aerial survey in 2002. Since that time oak mortality has expanded to cover more than 620,000 acres, most of which is attributed to natural spread of GSOB adults. Infestation rates on oaks on the Cleveland National Forest average 65% but are approaching 100% in areas with long-term tree mortality. Based on the above information, GSOB will likely continue to expand within and beyond the borders of the currently infested zone.

A separate satellite infestation and tree mortality was detected in 2009 in Marion Bear Memorial Park near La Jolla, north and west of the larger infested zone. This infestation may be the result of GSOB adults emerging from infested firewood brought into the nearby residential or recreational area and attacking nearby oaks. Currently, there are no regulatory measures in place to halt the movement of oak firewood from within the infested area despite the fact that this represents a significant pathway for introducing GSOB into uninfested areas. Observations indicate that GSOB adults can emerge from firewood for at least two seasons if the bark remains intact. It is likely that numerous additional infestations will be detected in the future beyond the current zone of infestation as a consequence of transporting GSOB-infested firewood. Regulation and outreach are likely the most effective tools to prevent the dispersal of GSOB. Education is ongoing to inform the public about the potential to move GSOB into currently uninfested areas via firewood, however the economic value of oak firewood will likely outweigh many conscious-minded publics.

3. Consequences of pest establishment:

Economic Damage Potential: HIGH risk (very certain)

GSOB is infesting up to 100% of host oak species in areas where the infestation had been ongoing for several years. Trees of high ecological, cultural and aesthetic value located in campgrounds, on administrative sites, and on tribal lands have been greatly affected and are being removed at high costs. The existing and future oak mortality will impact ecosystems for years to come in addition to the large increase in hazardous trees that threaten life and property. If GSOB continues to spread as expected, great economic losses are anticipated across all land ownerships. Assuming 10 to 20 dead trees/acre, the cost of removing 40 to 80,000+ dead oaks (averaged at \$500/tree) could range from 20 to 40+ million dollars. This would create a catastrophic cost for local governments, similar to the situation ongoing in the mid-west with ash tree removal for the invasive emerald ash borer.

Between 2008 and 2010 Cuyamaca Rancho State Park spent \$52,600, in addition to 1,300 person hours, removing hazardous oaks throughout the park. Several campsites were also closed

due to hazard tree concerns attributed to GSOB resulting in > \$400,000 loss of camping revenue and day use fees. In addition, San Diego Resource Conservation District has evaluated over 1,000 acres of private property in Descanso and surrounding areas in need of hazard tree removal and the Cleveland National Forest has spent over \$60,000+ on tree removal at campgrounds, picnic areas, fire stations, and along the Sunrise Highway.

Based on assessor's files and maps, the GSOB infestation in Ramona will affect at least 1,800 properties with an assessed land value of 225 million dollars, and secondarily affect 16,000 other properties with an assessed land value of 2.8 billion dollars over the next 5 years. Previous studies suggest that oaks contribute from 5 to 30% of the appraised values of real estate; partitioning this value across parcels of different sizes, cost of GSOB-caused tree mortality could be calculated as a direct loss of 25 to 40 million dollars of property value if oak die at the currently observed rate. Loss of property values to adjoining parcels is more ambiguous, but could range from 50 to 150 million dollars.

Ramona is one of 250 southern California communities with substantial numbers of oaks and oak woodlands. About half of these cities and communities use oaks as a defining element, and many have oak protection ordinances. Southern California counties have just less than half of the oak woodlands that could be affected by GSOB, so the economic impact of this species ultimately could be measured in billions of dollars.

Environmental Damage Potential: HIGH risk (reasonably certain)

The continued spread of this pest threatens oak resources and may permanently alter landscape ecosystems of California. The three primary host species cover over 39 million acres in California, and it is possible that other oaks overlapping the ranges of these species may be also be hosts.

Oaks may be the single most important trees used by wildlife for food and cover in California forests and rangelands. California black oak occupies more total area in California than any other oak species and its acorns are heavily consumed by livestock, mule deer, feral pig, rodents, mountain quail, wild turkey, jays, and woodpeckers. In addition, oak woodlands are also important habitat for several rare and threatened wildlife species. Native oak species are also valuable ornamentals. The deep shade and aesthetic appeal of California black oak make it a highly desirable landscaping tree.

Native Americans in Southern California have collected acorns for centuries. At one time, California black oak acorns were a tribal food staple. Loss of a significant part of the oak resource would greatly impact Southern California tribes, financially, in terms of hazard tree removal and restoration, and culturally in the inability to collect acorns and carry forward rich traditions to current and future generations.



Oak mortality at Cuyamaca Rancho State Park. Source: R. Porter



High value oak trees on private property near Descanso. Source: S. Smith

Perceived Damage Potential: HIGH (reasonably certain)

An extremely high level of crown dieback and mortality of oaks is anticipated. Trees are highly visible in many areas and their injury or mortality will be noticed. This will increase public concerns regarding hazard trees, fuel loads, aesthetics, loss of recreational opportunities and loss of high value trees. GSOB-caused tree mortality in native forests, particularly those outside of recreation areas or not along major transportation corridors may be less noticeable to the general public but will result in degradation of oak woodlands ecosystems and wildlife habitat. The local firewood industry may be affected; however, this will depend upon regulatory responses. The insect poses no direct threat to human health and is unlikely to cause public concern as a nuisance.

4. Pest Risk Potential: HIGH

Effects of GSOB on oaks are likely to be severe; however, there may be some differences in host preferences, and mortality and injury levels between oak species. Vertebrate insectivores and other natural enemies are not expected to control GSOB populations in the foreseeable future. Co-evolved natural enemies discovered in southeastern Arizona have not been found in California. As GSOB populations increase, the risk of accidental transport in infested firewood to other parts of California and beyond will be high. If GSOB escapes San Diego County, its impacts will be variable; primarily dependent upon the amount of host material available for reproductive sites and feeding and the location and value of the oaks affected.

5. Management Options

Regulatory control

Currently there are no State or Federal regulations directed at GSOB and/or the movement of GSOB-infested material. Regulatory measures may be necessary to prevent human-assisted spread through the transportation of GSOB in firewood and other wood materials.

Detection

Traps and ground surveys are effective at detecting GSOB in areas with and without observed tree mortality. Counties targeted for trapping in 2010 will include San Diego, Riverside and San Bernardino with additional sites located in the southern Sierra Nevada foothills and the central valley

In addition, the early stages of dying oaks can be detected in high resolution (resolution 1 ft) aerial photoimagery, and surveys of this imagery can be used as an early warning system to identify potential of GSOB outbreak. Combined with subsequent ground surveys, aerial photoimagery provides an efficient means of describing the extent of the GSOB outbreak on both public and private lands.

Hazard tree removal

Dead oaks on lands of all ownerships are being removed to abate hazards. Management, storage and disposal of infested wood and associated costs continue to present challenges. Determinations are underway to address the immediate and future needs for hazard tree abatement including funding requirements, potential funding sources and mechanisms for infested wood storage, grinding and disposal.

Individual tree protection

Insecticide application on the boles and large branches of high value trees is the only preventive management option currently recommended. This treatment is aimed at killing newly hatched larvae as they chew through the bark and will have no affect on larvae already present in the tree. Stem injection of systemic insecticides may be effective at killing larvae under the bark and are currently being evaluated.

6. Recommendations

- Quarantine regulations to prohibit the movement of potentially infested host material out of the infested area or regulations that require treatments (e.g. debarking, chipping, or other mitigating measures) prior to movement should be invoked.
- High value trees within the known areas of infestation should be protected against GSOB attack by application of insecticides to the main bole and larger branch stems.
- Support and implement the GSOB Strategic Plan and the Incident Action plan. Continue to use Situation Reports to keep cooperators apprised of ongoing efforts and activities.
- Continue to communicate with arborists, urban foresters, homeowners, land managers, etc., to increase awareness of GSOB, inform of potential pathways to prevent further spread and provide training on how to recognize the signs and symptoms of GSOB.
- Increase monitoring of GSOB in uninfested areas of the state that have host habitat and are likely receptors of beetles being transported in firewood.
- Develop techniques to improve detection methods and additional integrated pest management tools, including utilization of infested material via chipping, grinding, etc.
- Continue investigations into additional causes of oak decline and mortality in southern California, including work to describe recently detected pathogens in multiple oak species.

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References:

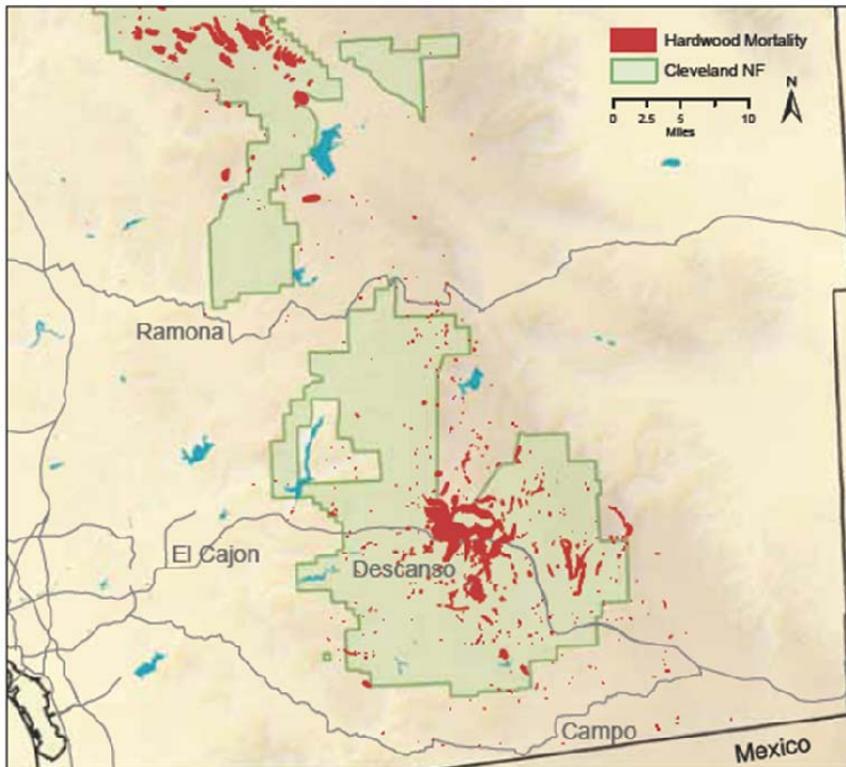
Coleman, T.W. and S.J. Seybold, 2008. New pest in California: The goldspotted oak borer, *Agrilus coxalis* Waterhouse. USDA Forest Service, Pacific Southwest Region, State and Private Forestry. Pest Alert R5-RP-022. October 18, 2008. [http://www.fs.fed.us/r5/spf/fhp/gsob/PEST%20ALERT%20\(A.coxalis\)](http://www.fs.fed.us/r5/spf/fhp/gsob/PEST%20ALERT%20(A.coxalis))

Coleman, T.W. and S.J. Seybold, 2008. Previously unrecorded damage to oak, *Quercus* spp., in southern California by the goldspotted oak borer, *Agrilus coxalis* Waterhouse (Coleoptera: Buprestidae). *Pan-Pacific Entomologist* 84: 288-300. [http://www.fs.fed.us/r5/spf/fhp/gsob/Coleman-and-Seybold-%2084\(4\)2008.pdf](http://www.fs.fed.us/r5/spf/fhp/gsob/Coleman-and-Seybold-%2084(4)2008.pdf)

Coleman, T. W., and S.J. Seybold. 2009. Striking gold in southern California: Discovery of the goldspotted oak borer and its central role in oak mortality. pp. 12-16, in K. A. McManus; K. W. Gottschalk (eds.). Proceedings, 20th U.S. Department of Agriculture Interagency Research Forum on Gypsy Moth and Other Invasive Species 2009, January 13-16, 2009; Gen. Tech. Rep. NRS-P-51. 114 pp., Newtown Square, Pennsylvania: USDA, Forest Service, Northern Research Station, December 2009.

Kliejunas, J.T., Tkacz, B.M., Burdsall, H.H., DeNitto, G.A., Eglitis, A., Haugen, D.A. and W.E. Wallner. 2001. Pest risk assessment of the importation into the United States of unprocessed Eucalyptus logs and chips from South America. Gen. Tech. Rep. FPL-GTR-124. Madison, WI. U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 134 p.

Smith, S.L. 2009. Goldspotted oak borer strategic plan. USDA Forest Service, Pacific Southwest Region, State and Private Forestry, Vallejo, CA. <http://www.fs.fed.us/r5/spf/fhp/socal/Goldspotted%20Oak%20Borer%20Strategic%20Plan%20September%202009.pdf>



Areas of tree mortality caused by goldspotted oak borer between 2002-2009.
Source: M. Woods

For more information:

- <http://www.fs.fed.us/r5/spf/fhp/gsob.shtml>,
- <http://groups.ucanr.org/GSOB/>
- www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html
- http://cirs.ucr.edu/goldspotted_oak_borer.html

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