Gold Spotted Oak Borer
Rapid Response Plan
for the Wrightwood Fire Safe Council

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Objectives

The objectives of this response plan are to provide: (1.) A plan of action and (2.) Provide general information in managing the gold spotted oak borer (GSOB) (scientific name: Agrilus auroguttatus) in Wrightwood and surrounding area in order to promote public safety, forest health, and minimize adverse effects on the environment.

Proposed actions would use an Integrated Pest Management (IPM) approach, utilizing all tools available in a coordinated manner in order to achieve maximum effectiveness.

While the infestation is well established, it is possible to suppress the beetle population and minimize tree mortality by executing a well-organized plan of action. This will require the support of the community at all levels.

Introduction

GSOB is an invasive insect pest first identified in Wrightwood in 2019. Experts believe it was established 5-10 years earlier, as it usually takes that long for an infestation to become apparent.

It infests and kills oak trees that are native to Southern California and the Wrightwood area. The affected tree species in Wrightwood are California Black Oak (Quercus kelloggi), Coast Live Oak (Q. agrifolia), and to a lesser degree Canyon Live Oak (Q. chrysolepis).

This infestation presents safety and economic threats to the Wrightwood Community. People and property are placed at increased risk of harm from falling trees and an increase in the overall fire hazard. Tree removal costs can also be quite expensive, ranging up to several thousand dollars per tree in the case of large high-risk trees that threaten property improvements. The insect prefers to infest larger diameter oaks which are an asset to property values and aesthetics. Larger oaks are more expensive to remove and present a greater hazard to people and assets at risk.

Background

Wrightwood

Wrightwood is an unincorporated community located in the San Gabriel Mountains of Southern California at an elevation of 5,935 feet. It is surrounded by the Angeles National Forest/San Gabriel Mountains National Monument. It is located on the San Bernardino and Los Angeles County line, with most (over 95%) of the residences located in San Bernardino County.

The area has a permanent population of 4,525 persons and an area of 5.9 square miles according to 2010 census data. There are approximately 2,700 residences and numerous small businesses. The area has many vacation homes, and during peak seasons the population can swell dramatically. Peak seasons are summer and winter, with many people camping, hiking, skiing, or snow playing as the seasons permit in the surrounding national forest and monument. Many weekend residents and tourists enjoy numerous other amenities available in the area. A major alpine ski area (Mountain High) is located 3 miles west of town. The community sits atop the San Andreas Fault, with the last major earthquake occurring in 1857.

The private forest lands are classified as a State Responsibility Area (SRA) for fire protection. The surrounding national forest and monument is in the Federal Responsibility Area (FRA). The community is in the Very High Fire Hazard Severity Rating Zone which is the highest wildland fire risk zoning in the state.

The natural environment is predominately a Jeffrey Pine forest with minor amounts of Sugar Pine, White Fir, and Incense Cedar that occur on microsites and with increasing elevation. Native oak species are California Black Oak, Coast Live Oak, and Canyon Live Oak which are dispersed throughout the forest. Stands of chaparral with a sparse conifer component occur predominately on the south facing slopes.

GSOB

GSOB is a wood boring beetle that is native to southeastern Arizona and northern Mexico. It is believed to be first introduced into Southern California (San Diego County) on infested oak firewood coming from its' native range in Arizona in the late 1990's or early 2000's. In its' native habitat it causes relatively little damage and is considered a minor pest as GSOB populations are kept in check by natural insect predators and diseases. By comparison, outside of their native range, GSOB populations can grow fairly rapidly as natural checks on reproduction and growth are not present. Host species are less resistant to GSOB attacks as they have not coevolved with GSOB in the environment.

Since first being found in San Diego County in 2004 it has spread through suitable habitat in Southern California. It was first found in Idyllwild in 2012, and in Wrightwood in 2019. An isolated area of infestation is in the Green Valley area of Los Angeles County primarily on private land. This is the northern and western most location of spread. Infestations have also been found in the Oak Glen, Forest Falls, and Big Bear areas in San Bernardino County.

Major jumps in the range and spread of GSOB are caused by the movement and importation of infested firewood. Once established it can spread short distances through natural dispersal.

It is imperative the plan incorporates information that the public, government officials, and industry personnel can use in managing and mitigating the effects of this infestation and minimizing the risk of spread to uninfested areas.

GSOB Biology

GSOB is a wood boring beetle. Female beetles lay eggs in the bark crevices of susceptible oaks. The eggs hatch and the larvae bore through the bark and feed on the cambium layer which is between the inner bark (phloem) and woody tissue (xylem). The cambium gives rise to new xylem and new phloem. The tree will die after multiple attacks on the cambium layer which girdle the circumference of the tree.

The beetles pupate inside the outer bark. Upon becoming adults, they bore out of the host tree, leaving a “D” shaped exit hole about 1/8 inch in diameter. The adults start to emerge in May to June and continue throughout the summer months. The adults feed on oak leaves for a short time. They mate, lay eggs on the tree bark, and the cycle repeats itself.

The lifecycle is typically one year, with successive generations over several years needed to kill larger trees. The beetle attacks susceptible oaks that are over eight to 10 inches in diameter at breast height (DBH-measured at 4 1/2 feet above the ground) on the lower trunk (in the lower 8 to 12 feet of the tree). They typically prefer to attack larger oak trees.

Signs of Infestation

In all oak species, small 1/8-inch diameter “D’ shaped exit holes will be present if successfully attacked by GSOB. If actively infested, approximately ½ inch to 3/4 inch long larvae with a somewhat flattened head can be found feeding on the cambium layer, which will be etched. Pupating adults may be found in the tree bark. Bark staining may

also be present. Woodpecker damage can also be a sign of infestation as they feed on beetles in the adult, pupal, and larval stages.

Unseasonal yellowing and thinning of oak tree crowns are the most apparent signs of infestation. California Black Oak trees are particularly susceptible to GSOB. Black oaks are deciduous and naturally lose their leaves in the fall and winter. Infested black oaks tend to retain many dead leaves over the winter and tend to stand out.

Coast Live Oak and Canyon Live Oak are evergreen oaks, with Coast Live Oak being the most susceptible. Crown yellowing and thinning at any time of year is cause for concern and a close inspection of these species would be warranted.

Determining the Extent of the Infestation in Wrightwood

In 2019 GSOB was discovered in the Acorn Canyon area of Wrightwood. Due to the amount of time that has elapsed, the entire Wrightwood area and surrounding National Forest could be considered infested.

However, knowing the actual extent and intensity of infestation would be useful. A comprehensive inventory of the distribution and degree of infestation would provide information for planning purposes. Conducting such an inventory would be quite challenging.

The community has approximately 3,000 lots which are privately owned. Based on a GIS estimate, there are about 1500 contiguous acres (including an approximate 500 ft. buffer on USFS/ANF lands) within the Wrightwood community that would need surveying. Adding in isolated parcels, picnic areas, campgrounds, and other priority locations, up to an additional 200-300 acres may need surveying as well.

Each property owner would need to be individually contacted to sign a release form. This would involve a mass mailing or distribution of flyers to each property owner. The mailings could be staged by area as the surveys progress. A website could also be established to electronically sign and receive release forms.

Due to the level of training needed and the amount of effort involved I would recommend that paid, trained personnel be used for the inventory. This would be the fastest and most efficient way to determine the extent of the infestation.

Survey data would be recorded in field data recorders and downloaded into a database. Tree locations would be tracked in a GIS system. This would identify lot by lot, the most heavily infested areas and individual trees. Decision makers could then target their efforts starting with the “Amplifier Trees” which are the most heavily infested.

This would require hiring and training personnel, and purchasing data loggers with GPS capability, appropriate software, and a computer system with backup to store and analyze data. This could be funded through a CALFIRE Forest Health Grant depending on funding levels and eligibility.

In March of 2022 the U.S.D.A.-Forest Service conducted training for approximately 6 to 8 interested residents of Wrightwood to become volunteer spotters who can identify infested trees and pass their knowledge to others in the community. They could assist paid inventory personnel and conduct community outreach and education efforts.

Options for Treatment

(Please note that links to several publications are listed at the end of the document that cover methods and timing of treatments, and other pertinent information.)

Use of Pheromones and Trapping for Monitoring and Control

Effective pheromones or other attractants for GSOB have not been developed to date, however research is being conducted. Initially lime green and pinkish-purplish colored sticky traps were thought to have some effect in attracting GSOB. They can be useful in trapping random GSOB beetles for monitoring purposes but have no effect on controlling the population.

Chemical Treatment

Trees can be chemically treated with pesticides to suppress an active infestation or prevent an infestation from occurring in the first place. However, such treatments would have limited effectiveness in saving individual trees that are heavily infested.

Tree injections involve specialized high-pressure equipment to inject pesticides into the tree bark either as a preventive measure or to suppress an active infestation. The insecticide is taken up via the trees vascular system. The effectiveness can last up to two years, depending on the insecticide, and will kill GSOB larvae under the bark, provided enough of the vascular system is intact and is able to distribute the insecticide effectively. It does cause some localized damage at the point of injection. This is generally the most expensive chemical treatment method, but the longest lasting. Insecticides approved for tree injection are nonselective meaning that all insects associated the tree could be potentially affected by the active ingredients.

Topical contact insecticides sprayed on the outside of the tree will kill newly hatched larvae as they bore into the tree, and adult beetles as they emerge from pupation. They

will not kill adult beetles or larva under the bark and are only effective on parts of the tree that are treated. Problems with drift can be an issue with topically applied insecticides. Following label directions for application, and monitoring wind speed and direction would minimize any potential drift. Contact insecticide treatments generally last about 6 months. Application timing is critical and should be conducted before the emergence of adult beetles starting in May. Links to USDA-Forest Service Forest Insect and Disease Leaflet 183 and other publications are located at the end of this document for further information.

All pesticide applications must be made in accordance with all federal, state, and county regulations and pesticide label recommendations. While individual property owners can apply pesticides legally available to homeowners, it is recommended that all pesticide application be done by licensed pest control businesses. They have the proper licensing, insurance, knowledge, training, experience, and equipment to conduct such activities and have access to insecticides that are unavailable to the general public. This will ensure that proper chemicals, techniques, and equipment are used, and required environmental and regulatory compliance is followed.

The use of pesticides is a very controversial and emotional issue for many people. It is highly regulated and technical in nature and could possibly present significant liability. For these reasons I would recommend that any pesticide treatments be left to the discretion and expense of the homeowner.

The California Department of Pesticide Regulation website has lists of currently licensed pest control businesses available on its' website at www.cdpr.ca.gov.

Tree Removal

Dead or heavily infested trees should be removed by a licensed and insured tree service as soon as possible. It is recommended that an arborist certified by the International Society of Arboriculture (ISA) be hired to ensure the work is done properly in accordance with industry standards and applicable regulations. A search tool for ISA certified Arborists is available on the ISA website at https://www.isa-arbor.com/.

Disposal of Infested Material

Note that tub grinders, large stationary chippers, and air curtain burners can be noisy and present a fire hazard consisting of embers, piles of logs, and wood chips. They should be located away from residences to avoid conflicts over noise and safety issues. They may also be regulated by state and local codes and ordinances pertaining to fire safety and location of industrial sites.

The site chosen must be in a currently infested area, so the infestation is not spread further. It must be large enough to accommodate the equipment and allow for access,

as well as storage of treated and untreated material. Operators must be trained, insured, and infested material must be treated in a timely manner to avoid adding to the local GSOB population. Fuel must be purchased, and the machine would require periodic maintenance as well. A loader and operator may also be needed to move material to and from the machine.

Chipping/Grinding

All oak slash and logs should be run through a chipper or tub grinder to kill as many GSOB larvae and adults as possible. The material can then be used for erosion control or mulch. While most tree service contractors have chippers that are towed behind their trucks, they usually handle only smaller (generally less than 8”-10” +/- diameter) material.

Larger infested material must be moved off site for treatment in a tub grinder or a much larger chipper. All material should be ground or chipped to a 3 inch or less size to ensure that no GSOB survive.

Air Curtain Burners

CAL FIRE has air curtain burners available for loan. They produce embers which would limit use during the fire season, which has been generally increasing in length and intensity each year. This would need a much larger area for a fire safe zone around the burner. For this reason, air curtain burners are not recommended during the fire season but are an option during the winter months.

Transport to a Transfer Station or Landfill

Another option is removing infested material to a San Bernardino County landfill or transfer station. The closest facility to Wrightwood is the Phelan Transfer Station, which is about 10 road miles away. At that location, woody material is dropped into a green waste bin, which is taken to the closest landfill (Victorville) when full. All green waste is run through a tub grinder on the day received at the landfill. All material would need to be effectively tarped or enclosed during transport to minimize chances of escape of GSOB adults.

Phelan and Victorville are in the Mojave Desert and have no naturally occurring native oaks that would be cause for concern. Disposal fees are charged by the ton and are updated periodically. Current fees can be viewed on the San Bernardino County Solid Waste website.

Retention of Infested Material by the Homeowner

Retention of infested material for firewood by the homeowner is strongly discouraged. It requires immediate covering with fine aluminum mesh material (#18 or finer) to

contain the beetles. The mesh appears to be only available in narrow (less than 6 foot wide) widths and is expensive. Overlapping bands of mesh would need to be sealed at the seams and the ends covered with soil at the ground line to prevent escape. Alternatively, it could be fashioned into a bag like enclosure. Each woodpile would need to be inspected to ensure the mesh is properly installed. There is no enforcement mechanism to ensure that it is done properly and in a timely manner.

Heavy clear plastic tarping has been used in the past; however, it does not allow the ventilation needed to quickly dry out infested wood to make it unsuitable for GSOB. The plastic typically lasts only one season and tears easily, while GSOB can remain active for up to 2 years. It does not retain enough heat to kill beetles even if the woodpile is placed in a sunny location. The beetles can also chew through it.

Any wood treated with insecticides should not be used as firewood under any circumstances for obvious safety reasons.

For these reasons I recommend that homeowners sign an agreement to release entitlement to any infested material as a condition of participating in the project. It would be removed and treated by the contractor. This will ensure that infested material is removed and treated properly, and none remains to further the problem by inadvertent movement of firewood.

Declaration of Zone of Infestation (ZOI)

The California Board of Forestry and Fire Protection (BOF) originally declared a ZOI for GSOB in 2012. It has since been amended and expanded three times to now include all of Orange County, and the portions of San Diego, Riverside, San Bernardino, and Los Angeles Counties that are outside of the Mojave Desert.

The value of establishing a Zone of Infestation for GSOB is linked to:

- Fostering collaborative efforts with both current and potential local, state and federal agency partners working on GSOB prevention, containment, control and remediation.
- Communicating the concern of both the Department and the Board for the GSOB issue and its current and potential impact in California to the public.
- Showing support from both the Department and the Board for efforts to seek funding, research, education outreach, best management practices for control, management efforts in managing GSOB-infested wood, and other GSOB related activities.
- Creating a directive that GSOB suppression and control measures be feasibly addressed in Timber Harvesting Plans within the ZOI (applicable only in mixed conifer stands where oaks are being harvested incidentally along with commercial species of conifers and a THP would be required).

- Establishes an official mapped boundary of the known GSOB infestation which can serve to notify communities in the current infested area and to alert communities in adjacent non-infested areas of the spread and threat of GSOB.
- Expressing the concern to the state legislature and governor's office about the potential impact and harm that GSOB could have statewide.
- Partnering with local governments in efforts to help stop the spread.
- Supporting the use of California Conservation Camp crews in control or management projects for insect and disease control on state and private forests.

Funding of Inventory and Treatments

The Zone of Infestation Declaration provides for a mechanism for cost sharing between the state, local government, and individual landowners to suppress insect infestations.

CALFIRE Forest Health Grants (FHG) funded through the California Climate Initiative (CCI) are available and appropriate for such a project. The yearly application deadline is usually around March 1. Other grants may be available as well. Each potential grant would need to be evaluated for applicability, level of funding, and administrative requirements.

Grantees are required to provide considerable documentation in the application and administration of grants which creates quite an administrative workload. This includes copies of all receipts, billings, payments, contracts, time sheets, pay documents, and all other pertinent documentation. The workload would normally be done by paid staff employed by the grantee. The applicable staff time and expense for grant administration would be billed to the grant as well.

For the previously mentioned reasons, and the fact that the line between Los Angeles and San Bernardino Counties bisects the area, I recommend that a Resource Conservation District, or other IRS 501 (c) 3 tax exempt organization experienced with grant writing, administration, and compliance be found. The grant would be administered in a more efficient, seamless manner, without regard to county jurisdiction as much as possible.

This is a large multi-year project that will require considerable time and effort to achieve desired results. The FHG/CCI grants generally have a three year time frame with unused funds from prior years being carried over to the next. Time extensions are available with justifiable reasons. Based on the size of the project and the high costs of tree removal I recommend $3,000,000 be considered for the initial grant funding request.

Environmental Compliance

Federal and state funded grants also require compliance with all applicable environmental regulations of the National Environmental Policy Act (NEPA) and/or the California Environmental Quality Act (CEQA) as applicable. An organization experienced with grant administration would be able to prepare and process environmental documentation and ensure regulatory compliance. Payment may be denied if any work that disturbs the ground and/or the vegetation takes place before full environmental compliance is completed and properly filed.

Regulation of Firewood Movement

While importation of firewood into the State of California is regulated by the California Department of Food and Agriculture, there is no regulation on the movement of GSOB infested firewood within the state or the ZOI.

County agricultural commissioners may also regulate transport of infested firewood, but no regulations have been imposed to date. Even if regulations were enacted, there is no effective enforcement mechanism to achieve regulatory compliance.

Public Information, Outreach, and Education

The best way to prevent new infestations is knowledge. This is achieved by educating residents, visitors, firewood producers and dealers of the risk of unintentional transportation of insect pests in firewood. The Wrightwood Fire Safe Council supported by public agency personnel would be instrumental in carrying out an educational effort.

A “Buy It Where You Burn It” educational campaign through contacting visitors and attendees at various community events, dispersing printed materials, GSOB identification cards, answering questions, etc. could be undertaken. Posters and educational literature can also be made available at visitor centers, campgrounds, and at businesses, especially those that deal in firewood or have high foot traffic.

Presentations at the meetings of service clubs, community groups, community events, and campgrounds can be made. Writing articles to be published in the local newspaper is another avenue to publicize the issue.

WFSC members can also be instrumental in using their personal contacts to educate homeowners hesitant about allowing inspections and tree removals on their property.

Forest Restoration

Some homeowners may wish to plant oak seedlings to replace trees that have been removed or to enhance existing stocking. Native and ornamental oaks are available from nurseries and garden centers.

Oak seedlings can easily be grown at home. They can be grown in biodegradable containers where the seedlings can be planted with the containers to minimize planting shock and increase survival. Oak seedlings could also be grown as a school or community project and handed out to residents at Earth Day or other suitable events.

Seedlings grown from acorns collected in the local area have the added advantage of being genetically adapted to the local soil and climatic conditions. Links to growing your own seedlings will be found at the end of this document.

Plan of Action and Recommendations

1.) The Wrightwood Fire Safe Council partner with a Resource Conservation District or other IRS 401(c) 3 nonprofit organization experienced with managing this type and scale of project.
2.) RCD/Nonprofit applies for grant funding.
3.) RCD/Nonprofit conducts a comprehensive inventory of oaks in the community to determine the level and concentration of infestation.
4.) RCD/Nonprofit Identifies and removes amplifier trees using licensed insured tree service contractors.
5.) In order to participate, homeowners must relinquish infested material to the contractor for proper treatment and disposal.
6.) The WFSC coordinates with the RCD/Nonprofit as the project progresses and act as a liaison with the community.
7.) WFSC conducts an ongoing public information and education effort.
8.) Any pesticide applications are the responsibility of the homeowners.

Links to Additional Resources

GSOB Information/Management/Maps
https://storymaps.arcgis.com/stories/39d5553c29354b4084f1b39dfa3274c0
https://ucanr.edu/sites/gsobinfo/
http://file.lacounty.gov/SDSInter/acwm/235108_Goldspottedoakborer.pdf
http://ipm.ucanr.edu/PMG/PESTNOTES/pn74163.html
http://ipm.ucanr.edu/PDF/MISC/GSOB_field-identification-guide.pdf

USDA Forest Insect & Disease Leaflet 183
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3833276.pdf

UC IPM Leaflet-Hiring a Pest Control Company
http://ipm.ucanr.edu/PMG/PESTNOTES/pn74125.html

California Department of Pesticide Regulation
https://www.cdpr.ca.gov/

CALFIRE Forest Health Grant Information
https://www.fire.ca.gov/grants/forest-health-grants/

Information on Firewood
http://firewood.ca.gov/

International Society of Arboriculture
https://www.isa-arbor.com/

Growing Your Own Oak Seedlings
https://ucanr.edu/sites/gsobinfo/files/76820.pdf
https://ucanr.edu/sites/gsobinfo/files/161811.pdf

Oak Management
https://oaks.cnr.berkeley.edu/resources/