Melanie Schlotterbeck

Tree Infestations Impact Local Parks

Friends of Harbors, Beaches and Parks (FHBP) set out to evaluate which parklands in Orange County have trees impacted by destructive non-native beetles. This factsheet outlines the results of our research. Data were compiled from OC Parks, the Orange County Transportation Authority, and UC Riverside/UC Extension Program.

Background

California is known for its diverse landscapes, attractive Mediterranean climate, and unique plant and animal life. During the Pleistocene (Ice Age) only portions of the Sierra Nevada had glaciers—the rest of the state remained untouched by ice. This uninterrupted time to differentiate gave our plants and animals thousands of years to evolve into specialized niches. Our geology, weather, and unglaciated landscape has allowed the Golden State to harbor 2,200 endemic species—species found nowhere else.

This history lends itself to many interesting, localized, and sensitive plant and animal species. Many of the species that live here have populations that are dwindling due to urbanization from increased development pressures.

Orange County has several flora and fauna identified as threatened or endangered by state and federal natural resource agencies. Most of these species rely on intact and healthy habitats to live. Our area has over 20 types of native trees found in rural, suburban, and urban settings. Trees are valued for several reasons including providing shade, sequestering carbon, reducing soil erosion, converting carbon dioxide to oxygen, and serving as foraging and nesting locations for many wildlife species—mostly birds.

However, despite the vital roles that trees play in our landscapes and watersheds, Orange County is the only county in Southern California that does not have any protections for native tree populations. For example, Orange County has the

world's northern most stand of Tecate Cypress (shown right) located just south of the 91 Freeway in Anaheim. There are just 20 stands worldwide—with populations only found in Orange and San Diego Counties and Baja California. But no law or ordinance exists currently to protect the trees.

Climate change, droughts, wildfires, and other man-made and natural pressures have stressed tree populations. When trees are stressed everything changes for them—their reproduction, growth priorities, internal structure, ability to absorb nutrients and water, and more. These stresses—especially when ongoing and cumulative—make them more vulnerable to insect infestations.

Across the Western US, numerous states have dealt with massive tree losses in forests and mountain tops. And now locally, high infection rates, mortality rates, increase in infestation spread, and the potential devastating loss of local native trees have brought the issue to the forefront.

Jeff Yann

Tree Infestation Overview

Researchers at the University of California, Riverside and the UC Extension Program are tracking tree infestations in Orange County and other local areas. While there are several known harmful beetles, two key insects are wreaking havoc on our native trees: the Invasive Shot Hole Borer (ISHB) [formerly Polyphagous Shot Hole Borer] and the Goldspotted Oak Borer (GSOB).

Invasive Shot Hole Borer

Ken Walker

The ISHB is an exotic beetle imported from Southeast Asia. It is believed this bug was brought over in containers and shipping material across the ocean to California. The small beetle creates a circular hole in the tree from 0.4 to 1.57 inches in size—with many exit holes from its larvae. This beetle loves riparian trees—mostly California Sycamores—but can impact Box Elders, Coast Live Oaks, English Oaks, Big Leaf Maples, American Sweetgum, and several fruit-bearing trees.[1]

When the beetle exits the tree there is a white powdery substance by the exit hole. This substance is one of two fungi the beetle carries. Once the female burrows into the tree, it deposits the eggs and grows the fungi, which serves as a food source for the larvae.[2] The fungi cause a tree disease called Fusarium Dieback. This dieback occurs because the pathways for the transport of water and nutrients by the xylem and phloem are interrupted—causing the tree to eventually die.[3]

Key signs indicating a tree has been infected, include staining (discoloration of the bark), gumming (clots or drips of sap), sugary exudate (buildup of sugary white substance), and frass (an accumulation of boring dust and insect excrement). Also, the beetles can sometimes be seen sticking out of the entry hole—proof positive of an infestation. Recent research also indicates that the non-native invasive plant castor bean hosts the ISHB as well. Removal of this plant helps the native trees avoid possible exposure to the ISHB.[4]

Solutions to the ISHB are limited because the beetle tends to colonize both dead trees and live trees. If the tree has been infected, the tree should be chipped in situ and covered with a tarp with the edges secured down or buried for at least a week to prevent further colonization. This solarization (heating under the sun's light) will cause the remaining beetles to die off and, with the tarp secured, they will be unable to escape. This is such an invasive pest, even the equipment used to treat the tree must be sterilized to prevent further infection in other trees.[5] The chances the tree will survive a moderate to heavy infestation are very low.

Goldspotted Oak Borer

The GSOB is native to southern Mexico and southeastern Arizona. After being introduced to San Diego County, it has spread northward. It only invades oaks (mostly in the red oak family)—including the Coast Live Oak, Canyon Live Oak, and California Black Oak. This beetle creates a "D" shaped exit, which is larger than the ISHB exit hole. This GSOB beetle seems to prefer mature trees.

This insect is bullet-shaped and reaches 0.393 inches long. Adults are easily identified with six gold dots on the forewings and thorax. Females lay eggs on the tree bark and the larvae then bore into the tree's xylem and phloem disrupting nutrient and water flow.


Mike Lewis

A tree is known to be infected when "D" shaped holes appear (exit locations for larvae) on the exterior of the tree. The damage associated with GSOB includes crown thinning and dieback, bark stains, and excessive bark injury from woodpecker foraging. It appears that it takes several years of repeated invasion and injury from the beetles before the tree dies.

Trees that have experienced crown thinning and have more than 100 exit holes will die. Additionally the size of the tree matters. Trees with a diameter at breast height of 18 inches or more are the most likely to die.

GSOB control measures are currently limited, with efforts focused mostly on limiting spread and protecting healthy trees. While the bug has three primary natural enemies, further research is needed to determine whether they can be used to control infestations. Insecticide treatments can be used to prevent infestation.[6]

To ensure the oak borer doesn't continue its spread, infected trees should be felled and ground down to wood chips less than three inches in size. Timing is also critical—this mechanical treatment must occur before the emergence of adults in May. If grinding is not feasible, infested cut wood can be tarped and solarized with the edges buried under soil for two years to prevent adults from escaping.[7]

Many bird species are dependent on trees for cavity nesting and snags for perching. Land managers will need to work with arborists to identify which trees are safe to remain and which aren't. A woodland devoid of living trees is no longer a woodland.


Melanie Schlotterbeck

Our Research

Unfortunately, both ISHB and GSOB are already found in Orange County. FHBP completed an analysis of these infestations in Orange County Parks as well as the seven Orange County Transportation Authority (OCTA) Preserves. This data were overlaid with digital maps of Orange County and associated federal, state, and regional parkland ownerships.

The OC Parks digital data set included a tree inventory of more than 37,000 trees, which included an ISHB inventory ranking infestations. For GSOB, the rankings were simply if the tree was infested, removed, or burned in a fire. While OCTA's digital data for ISHB included a tree list—no tree inventory was provided. In addition, OCTA gave verbal results from a new tree survey that they received in mid-June.

Our research excluded State Park lands, the Cleveland National Forest, and the Seal Beach Wildlife Refuge because of lack of available data. Due to the proximity and adjacency of many parklands, though, we kept those state and federal lands on our map for context because a possible spread of these two beetles into those regions is highly probable.

The risks associated with tree infestations depends on how severe the infestation is, the stress the tree is under, the proximity to other trees, drought conditions, and if the tree is considered a "super spreader." For example, if a lone tree has a high level of infestation, but is far enough away from other trees, there is a significantly lower potential that tree spreads the infestation because the beetles can't fly far. This is unlike woodlands of the same tree species packed closely together—one infested tree that remains in place and untreated, could mean death to the entire woodland.

Within the OC Parks data, the infestation levels were identified as follows for ISHB:

- None: no infestation
- Low: 1-49 exit holes
- Moderate I: 50-150 exit holes
- Moderate II: >150 exit holes
- High: 150+ exit holes plus dieback

The OCTA Preserve data did not include the number of exit holes, but rather put trees in infestation categories of Low, Medium, and High.

Therefore, for this analysis, we included only the OC Parks Moderate I, Moderate II, and High infestation levels; and the OCTA Medium and High levels.

No other details were provided by OC Parks on GSOB other than the presence of an infestation. OCTA only provided a verbal confirmation of one incident on one preserve with a GSOB infested tree.

Impacts to Parklands

All together, 133,865 acres of conserved land exist within Orange County, including hundreds of miles of trails for residents and visitors to enjoy. That said, diseased and damaged trees are being reported more frequently by homeowners, land managers, foresters, cities, and recreational users. Dead and dying trees present a clear and present danger—not only to the infected tree as it becomes fuel for fires—but also because broken branches can fall unexpectedly and compromise trail, sidewalk, and road safety. In fact, many new infestations are occurring because diseased trees—in the form of campfire wood—are being brought into uninfected areas. This is one of the key causes for spread for the GSOB.

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This tree is severely infected with the ISHB.

Melanie Schlotterbeck

This lone tree would have less beetle spreading capability.

Within the OC Parks data, 6,960 trees had some level of ISHB infestation—a total of 18% of surveyed trees. The Moderate I & II and High infestation levels included 1,469 of those infested, or 21% spanning 22 different County parks. And, of the 1,955 trees surveyed for GSOB, 17% (336 trees) had some level of infestation in four parks.

OCTA data shows 14 trees with some level of ISHB infestation, but seven trees with a Medium or High ranking (50%). The total number of surveyed trees was not specified in the data provided. The ISHB was found on two of the preserves, while GSOB was only found at one preserve—in one tree.

Gloria Sefton

A reminder to campers to save the local trees!

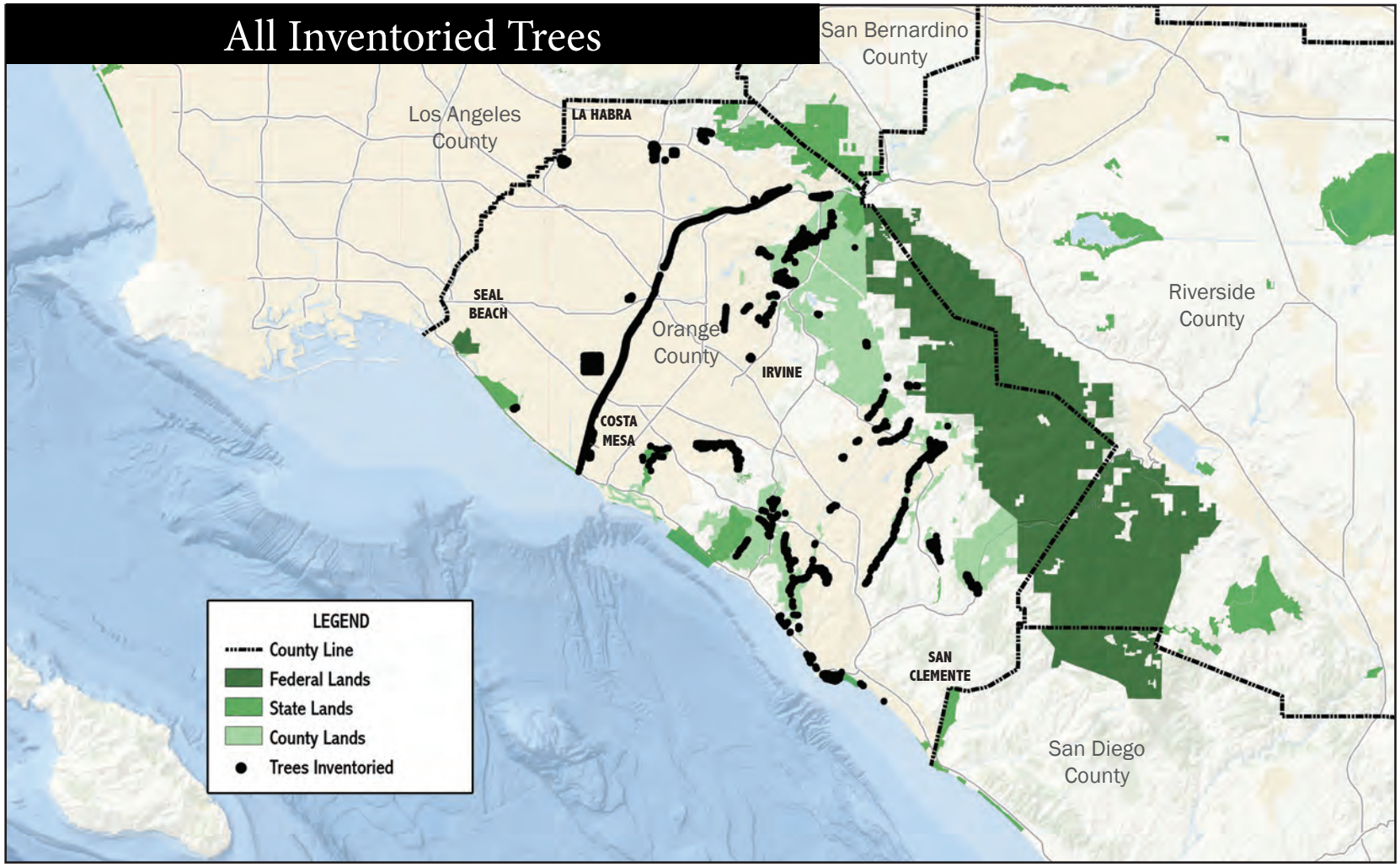
Claire Schlotterbeck

A dead oak tree near an oak woodland.

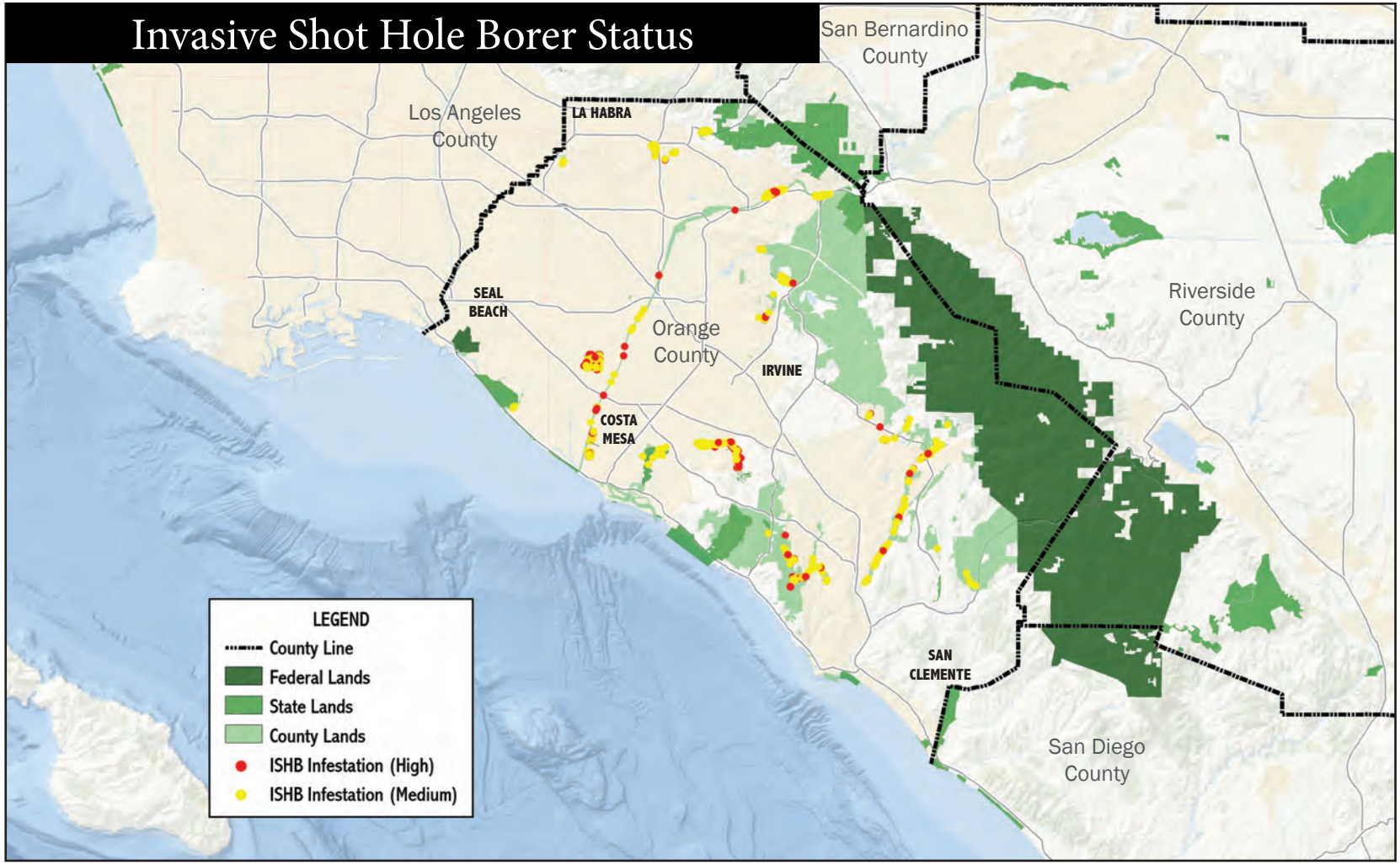
Land Manager	Type of Beetle	
County of Orange	**ISHB**	**GSOB**
Aliso & Wood Canyons Wilderness Park	✓	
Carbon Canyon Regional Park	✓	
Featherly Regional Park	✓	
Fremont Canyon Nature Preserve		✓
George Key Ranch Historic Park	✓	
Gypsum Canyon Nature Preserve		✓
Harriett Wieder Regional Park	✓	
Irvine Regional Park	✓	
Laguna Coast Wilderness Park	✓	
Laguna Niguel Regional Park	✓	
Mile Square Regional Park	✓	
O'Neill Regional Park	✓	
Peters Canyon Regional Park	✓	
Ralph Clark Regional Park	✓	
Ronald Caspers Wilderness Park	✓	
Santa Ana River Greenbelt	✓	
Santiago Oaks Regional Park	✓	✓
Talbert Regional Park	✓	
Ted Craig Regional Park	✓	
Tri-City Regional Park	✓	
Upper Newport Bay Nature Preserve	✓	
Weir Canyon Nature Preserve		✓
Whiting Ranch Wilderness Park	✓	
William Mason Regional Park	✓	
Yorba Regional Park	✓	

Land Manager	Type of Beetle	
Orange County Transportation Authority	**ISHB**	**GSOB**
Trabuco Rose Preserve	✓	✓
Wren's View Preserve	✓	

It is important to note that the original GSOB infestation on OC Parks land was found early in Weir Canyon, and efforts to contain the spread were taken immediately. This has helped prevent the spread to other natural lands. New treatments (insecticides) are being evaluated for their efficacy by the UC Extension Program, but early data already show some success killing the GSOB larvae.



Digital Data Sources: U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, California State Parks, OC Parks, Orange County Transportation Authority, and National Ocean and Atmospheric Administration



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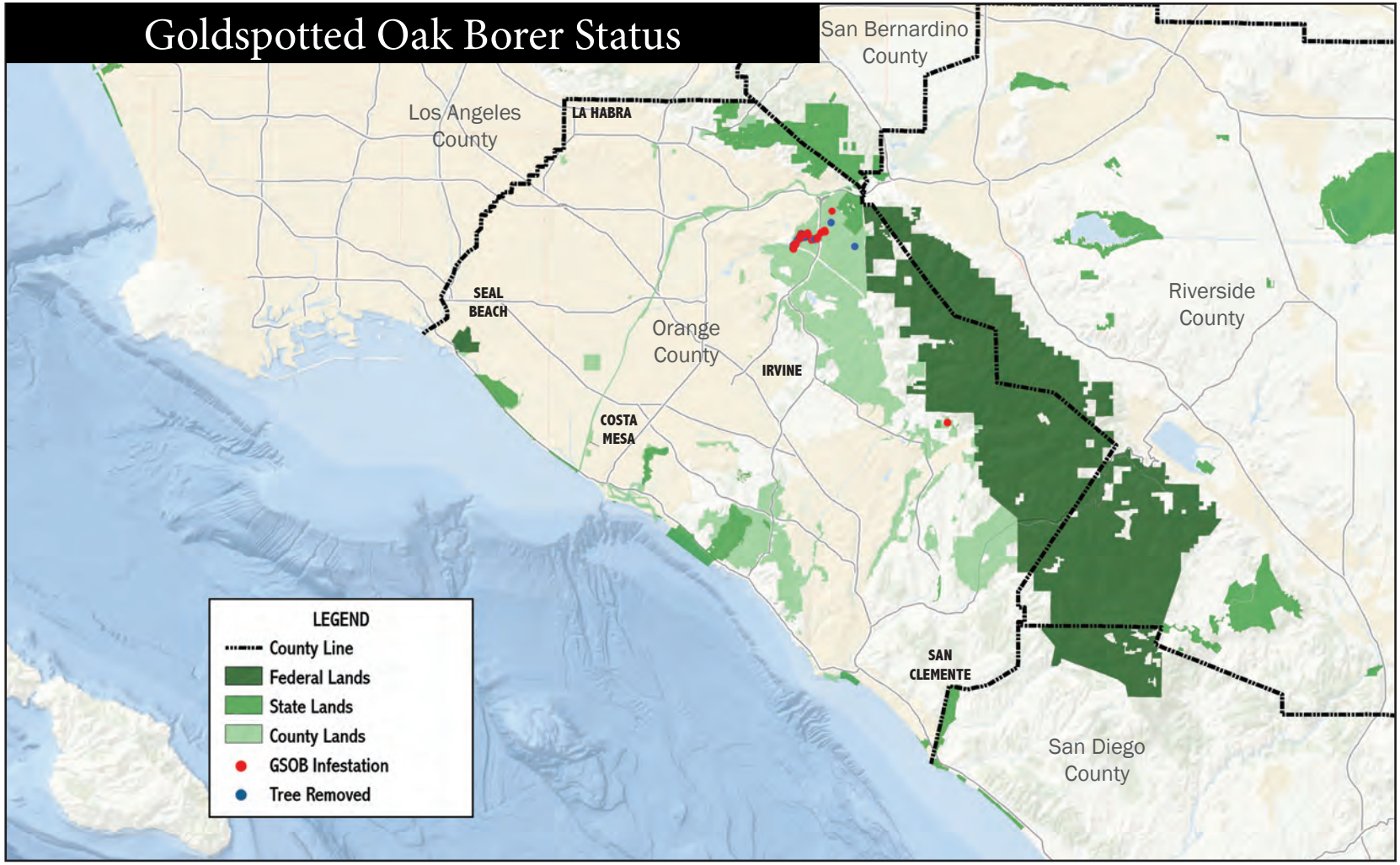

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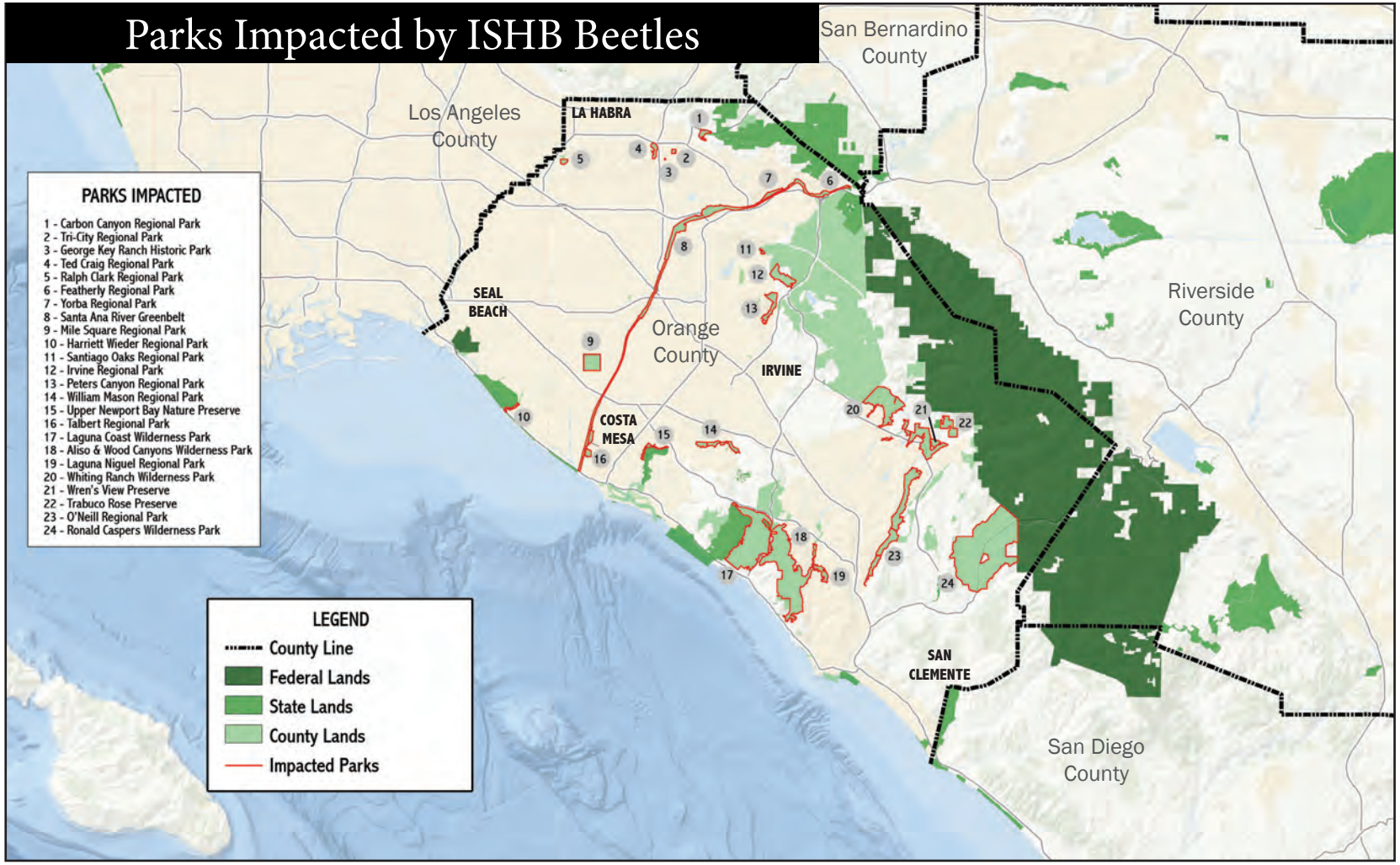

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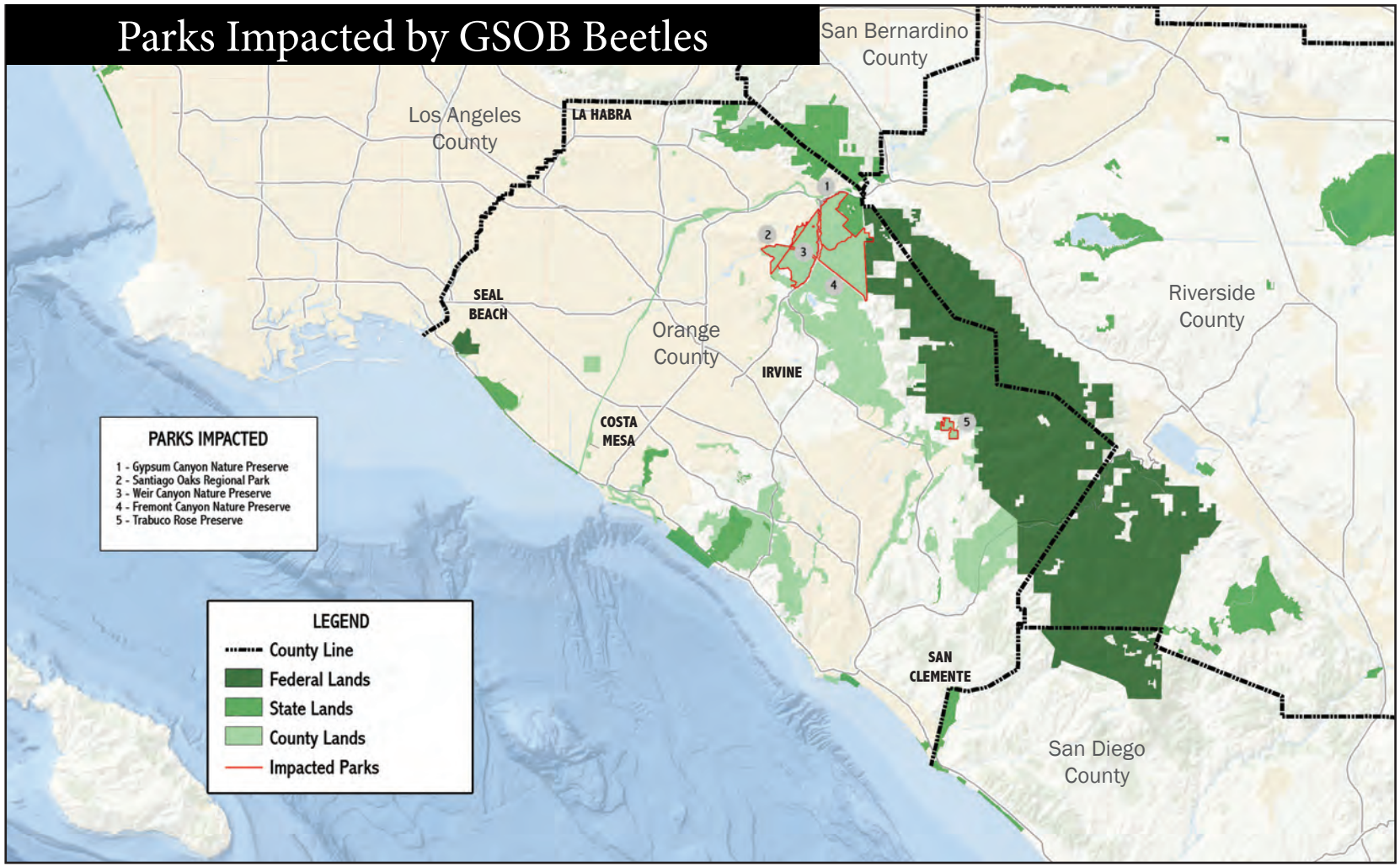

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Conclusion

Gloria Sefton

If ISHB and GSOB infestations are not contained, trees that we know and love throughout the county could be lost forever, with devastating impacts to the urban tree canopy, parks, and natural ecosystems.

Some solutions to decrease beetle invasions include preventive measures to reduce tree stress, pesticide use, and horticulture techniques. Limiting tree and root damage from human activity, deep watering during droughts, and avoiding soil compaction to allow soil porosity/access to moisture, are preventive measures that can help healthy trees fight infestations. While not ideal due to potential habitat and species impacts, chemical spraying several times a year can reduce infestations as well. On the horticulture side, options include thinning trees so competition for sun and water are reduced and fertilizing the soil to assist with growth.[8]

While there are limited solutions for existing infestations, there are some basic solutions that can be implemented immediately that should help prevent future infestations. These include: ensuring imports do not contain invasive pests, stopping the spread from existing problem trees, and reminding residents to "buy it where you burn it" to keep beetle infestations in their existing geographies. Campers have unknowingly transported the GSOB from park to park by bringing in firewood from infested trees. Although it may be tempting and cheaper to cut an infested dead or dying tree into firewood rather than dispose of it properly, such actions actually contribute to the spread.

Containment is a key strategy and infested trees should be dealt with quickly to prevent further spread. If trees are left in place to fester with an infestation, we may lose many more trees. Chipping and grinding, or tarping and solarizing cut wood are two techniques that can kill the borers in an infested tree. This effort, while sacrificing infested trees that may or may not survive, would be aimed at protecting the larger stands of woodlands and other nearby trees.

Further, tree protections should be incorporated in the Orange County Zoning Code. Fortunately, FHBP has already taken great steps to create a Tree Preservation Policy that affords trees much needed protections, on lots of a certain size and with specific trees that meet certain size requirements. This Tree Preservation Policy is slated to go before the Orange County Board of Supervisors in July 2020.

This report was released in June 2020.

Appendix

Trees impacted by ISHB:[9]

- Box Elder (*Acer negundo*)
- Big Leaf Maple (*Acer macrophyllum*)
- California Buckeye (*Aesculus californica*)
- White Alder (*Alnus rhombifolia*)
- Mulefat (*Baccharis salicina*)
- Blue Palo Verde (*Cercidium floridum*)
- California Sycamore (*Platanus racemosa*)
- Fremont Cottonwood (*Populus fremontii*)
- Black Cottonwood (*Populus trichocarpa*)
- Mesquite (*Prosopis glandulosa*)
- Coast Live Oak (*Quercus agrifolia*)
- Canyon Live Oak (*Quercus chrysolepis*)
- Engelmann Oak (*Quercus engelmannii*)
- Valley Oak (*Quercus lobata*)
- Goodding's Black Willow (*Salix gooddingii*)
- Red Willow (*Salix laevigata*)
- Arroyo Willow (*Salix lasolepis*)

Trees impacted by GSOB are mainly in the "red oak group":

- Coast Live Oak (*Quercus agrifolia*)*
- California Black Oak (*Quercus kelloggii*)*
- Canyon Live Oak (*Quercus chrysolepis*)

* red oak group

Trees species in the Tree Preservation Policy:

- Coast Live Oak (*Quercus agrifolia var. agrifolia*)
- California Black Oak (*Quercus kelloggii*)
- Engelmann Oak (*Quercus engelmannii*)
- Canyon Live Oak or Golden Cup Oak (*Quercus chrysolepis*)
- Valley Oak (*Quercus lobata*)
- Oracle Oak (*Quercus Xmorehus*)
- California Scrub Oak (*Quercus berberidifolia*)
- Nuttall's Scrub Oak (*Quercus dumosa*)
- Interior Live Oak (*Quercus wislizeni var. frutescens*)
- Torrey's Oak (*Quercus Xacutidens*)
- Muller's Oak (*Quercus cornelius-mulleri*)
- Southern California Black Walnut (*Juglans californica*)
- California Sycamore, or Western Sycamore (*Platanus racemosa*)
- Tecate Cypress (*Hesperocyparis forbesii*)
- Black Cottonwood (*Populus trichocarpa*)
- Fremont Cottonwood (*Populus fremontii*)
- Black Willow (*Salix gooddingii*)
- Red Willow (*Salix laevigata*)
- Pacific Willow or Yellow Willow (*Salix lucida var. lasiandra*)
- Arroyo Willow (*Salix lasiolepis*)
- White Alder (*Alnus rhombifolia*)

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[1] UC Riverside. "Fusarium Dieback on California Avocado Trees Vectored by Polyphagous Shot Hole Borer (*Euwallaceae sp.*)" Factsheet.
[2] UC Riverside. "Polyphagous Shot Hole Borer." Last retrieved 22 Jun 2020 via the University's website: *https://cisr.ucr.edu/invasive-species/polyphagous-shot-hole-borer*.
[3] UC Riverside. "Polyphagous Shot Hole Borer + Fusarium Dieback A New Pest Complex in Southern California" Factsheet.
[4] US Department of Agriculture. "Pest Alert: New Pest Complex in California: The Polyphagous Shot Hole Borer, *Euwallacea sp.*, and Fusarium Dieback, *Fusarium euwallaceae*." Last retrieved on 22 Jun 2020 on the Department's website: *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5441465.pdf*.
[5] UC Riverside. "Fusarium Dieback on California Avocado Trees Vectored by Polyphagous Shot Hole Borer (*Euwallacea sp.*)" Factsheet.
[6] University of California Agriculture and Natural Resources. Pest Notes. "Goldspotted Oak Borer." January 2013.
[7] U.S. Department of Agriculture. Forest Insect and Disease Leaflet 183 "Goldspotted Oak Borer." March 2015.
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[9] California Native Plant Society. "Racing to Stop the Destructive Shot Hole Borer." Last retrieved on 16 Jun 2020 on the Society's website: *https://www.cnps.org/flora-magazine/racing-to-stop-the-destructive-shot-hole-borer-11489*.