

## Lessons learned (the hard way) on how to manage Invasive Shot Hole Borers

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### Insect-disease complex: Invasive Shot Hole Borers-Fusarium dieback

#### Insect vector: ISHB



Euwallacea fornicatus Polyphagous Shot Hole Borer **(PSHB)** 

Euwallacea kuroshio Kuroshio Shot Hole Borer **(KSHB)** 

#### Fungal Disease: Fusarium dieback



Fusarium euwallaceae



Fusarium kuroshium

✓ Two species present in California

✓ Morphologically indistinguishable









# Hosts very susceptible to ISHB/FD (causes tree death)

Acer buergerianum - Trident maple Acer macrophyllum - Big leaf maple\* Acer negundo - Box elder\* Parkinsonia aculeata - Palo verde *Platanus racemosa* – California sycamore\* *Platanus* x *hispanica* - London plane *Populus fremontii* – Fremont cottonwood\* *Populus nigra* - Black poplar\* *Populus trichocarpa* - Black cottonwood\* Quercus lobata - Valley oak\* *Quercus robur* - English oak Ricinus communis - Castorbean Salix gooddingii - Black willow\* Salix laevigata - Red willow\* Salix lasiolepis - Arroyo willow\*



\* California natives

Find full list of reproductive hosts in California: **WWW.ishb.org** 



# What have we learnt about managing ISHB-FD?

- 1. Monitor your trees (find infestations early)
- 2. Treat only infested trees
- 3. Remove amplifier trees
- 4. Correctly dispose infested material



## 1. Monitor your trees

- ✓ Visual assessment
- Trapping (using lure: quercivorol)



## External signs & symptoms



Entry holes the size of the tip of a medium ball-point pen (~ 0.85 mm diameter)

When we remove the first layer:





Frass (sawdust)

Sugary exudate

## 2. Treat only infested trees



#### Treatment options (low-moderate infestation):

#### **Combination of insecticides + fungicides**

- **Trunk sprays:** Bifenthrin + *Bacillus subtilis* (+ surfactant to increase penetration into bark)
- Systemic soil injection/drench: Imidacloprid
- **Trunk injection:** Emamectin Benzoate + Tebuconazole or Propiconazole
- Basal trunk spray: Dinotefuran (mixed results)

**Repellents:** Verbenone and piperitone (being tested)

Biological control under research: medium and long-term solutions









## 3: Remove amplifier trees/branches

- >150 active entry holes + dieback
- Big sources of beetles

- Vascular system too compromised
- Might become hazards
- Follow tree removal with stump removal / grinding



## 4. Correctly dispose infested material

## This is a lot of extra work, expensive, and time consuming... Why should I bother?

- ✓ Chipping < 1 inch kills 99.9% of beetles</p>
- ✓ Chipping < 3 inch kills 98% beetles</p>
- ✓ Chipping + solarizing or composting kills 100% of beetles
- ✓ Logs must be solarized or kiln-dried
- ✓ Always cover load when in transit



# Green waste is a major pathway of ISHB dispersion

✓ 1 beetle/gallon of big chips (2-5 inch) from heavily infested wood

ightarrow 200 beetles /cubic yard of infested mulch





## Firewood movement as a pathway



Many other tree pests use firewood and green waste as pathways for dispersion

![](_page_16_Picture_1.jpeg)

Mediterranean Oak Borer (Xyleborus monographus)

MOBpc.org

Gold-Spotted Oak Borer (Agrilus auroguttatus)

![](_page_16_Picture_5.jpeg)

![](_page_16_Picture_6.jpeg)

## ISHB resources

![](_page_17_Picture_1.jpeg)

#### www.ISHB.org

![](_page_17_Picture_3.jpeg)

#### **ISHB** update

![](_page_17_Picture_5.jpeg)

#### **ISHB Invasive Shot-hole Borers**

![](_page_17_Figure_7.jpeg)

#### Thank you!

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![](_page_18_Picture_2.jpeg)

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#### www.ISHB.org

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