Invasive Shot-Hole Borers + Fusarium Dieback
Prioritizing Management Efforts

HOW TO USE THIS CHART

This chart is intended to help inform ISHB (Polyphagous and Kuroshio Shot-Hole Borers) management decisions. Consider potential safety hazards, tree value (economic and ecological), available resources, and other factors unique to each situation when using this tool.

REPRODUCTIVE HOSTS

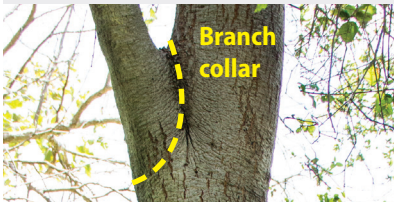
A reproductive host is a species that supports 1) ISHB reproduction and 2) growth and development of the beetle's symbiotic fungi. These species are currently the priority for control efforts as they can produce more beetles that may spread the infestation. Some of the more susceptible reproductive hosts appear to be box elder, castor bean, valley oak, Engelmann oak, coral, and several species of sycamore, willow, and cottonwood.

Visit pshb.org for the full host list.

LIMB FAILURE HAZARD

The point of attachment between a tree branch and the main stem is called the branch collar. ISHB infestation in this area poses a serious safety hazard: a weakened collar may not be able to support the weight of the branch, creating potential for limb failure.

Infested trees—including those that have been treated or pruned—must be regularly monitored so that hazards can be identified and removed. When monitoring, consider beetle attacks in the branch collar as part of the branch.



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IDENTIFYING + MANAGING ISHB: SUGGESTED STEPS

Identify the pest. Does the tree have multiple entry-holes with staining, gumming, frass, and/or sugar exudate?

- Yes → Scrape away the bark. Is the entry-hole about the size of the tip of a ball point pen? (~.85mm)
  - Yes → Is the tree a known reproductive host?
    - Yes → View the map at ucanr.edu/sites/pshb/map. Has ISHB been found in your city?
      - Yes → **Assess the damage.** Where is the infestation located?
        - **Branches Only** → Prune branches, treat cuts, and monitor*
        - **Trunk + Branches** → Does the tree have branch dieback?
          - No → Count active gallery holes. Look for clusters on the trunk and individual branches.
            - ≥50 (branch ▲ / trunk ▼) → Treat and monitor tree*
            - <50 → Is the tree a reproductive host?
              - Yes → Treat and monitor tree*
              - No → Monitor tree regularly*
          - Yes → **Choose one:**
            - Remove entire tree
            - Treat and monitor tree if tree is of special value and **not** an isolated infestation
      - No → Send photos and a report to UC Riverside at eskalenlab@gmail.com. Is a ISHB-FD infestation confirmed?
        - Yes → **Assess the damage.** Where is the infestation located?
        - No → Symptoms may be caused by other factors. Consult a tree specialist.
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  - No → Symptoms may be caused by other factors. Consult a tree specialist.
- No → Symptoms may be caused by other factors. Consult a tree specialist.

Dispose of all infested material. Are plant parts small enough to chip?

- Yes → Chip wood parts to less than 1″ in diameter
  - **Choose one:**
    - Solarize with clear tarp
    - Compost at commercial facility
    - Burn at biogeneration facility
    - Send to landfill for use as Alternative Daily Coverage
    - Chips that are not solarized, composted, or kiln-dried may only be used as mulch in ISHB heavily infested areas
- No → **Choose one:**
  - Solarize with clear tarp according to guidelines
  - Disinfect wood by kiln drying (60 min at 60°C)

** Tree removal is an option for trees of any infestation level.*

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Invasive Shot-Hole Borers + Fusarium Dieback
How to Handle Infested Plant Material

CURRENT OPTIONS

Options for handling infested plant material include the following:

- Chip (less than 1") + compost
- Chip (less than 1") + solarize
- Cut logs + solarize
- Chip (less than 1") + deliver to landfill for use as Alternative Daily Coverage
- Cut logs + kiln-dry

Guidelines for effective solarization and composting are included below.

****If relocating infested material, cover in-transit to prevent beetles from escaping****

SOLARIZATION GUIDELINES

Solarization is a suitable method for handling either infested chips or logs. When done properly, solar energy will heat plant material until both the beetle and fungi are killed. It is most effective during the peak of summer, when temperatures are higher and days are longer, but may be used during the rest of the year as long as time and space can be committed.

Follow these tips for proper solarization:

- Use sturdy plastic sheeting/tarp (clear is recommended) that can withstand rain/wind
- Fully contain chips/logs by wrapping plastic both underneath and over the material
- During July - August: cover chips/logs with sturdy plastic for **at least 6 weeks**
  - Temperatures during these months should be regularly above 95°F
- During September - June: cover chips/logs with sturdy plastic for **at least 6 months**
- **Keep log/chip layers as thin as possible** (2 logs deep maximum) to ensure even heating throughout the pile

COMPOSTING GUIDELINES

When done correctly, composting can effectively control the plant pathogens that cause Fusarium Dieback. Composted, chipped plant material may then be repurposed as mulch or added back into soil to improve texture and water retention.

Requirements for adequate decomposition

If transporting chipped material is not an option, you can compost chips yourself. These general composting guidelines will help assure the destruction of pathogenic fungi.

- Woody material should be chipped to less than 1 inch.
- A mixture of equal volumes of green plant and dry plant material will normally achieve a proper carbon-to-nitrogen ratio of 30 to 1.
- Do not add soil, ashes from a stove or fireplace, dairy or meat products, or manure from meat-eating animals.
- A pile should be in bins at least 36 x 36 x 36 inches to assure adequate heating. Maintain a temperature of 160°F, turn the pile every 1-2 days, and add nothing to it once the composting process has begun. If temperatures do not get up to 160°F within 1-2 days, the pile is too wet or dry. If too dry, add water. If not enough nitrogen, add green material.
- Healthy compost has a pleasant odor, gives off heat as vapor when turned, has a white fungal growth on the decomposing material, gets smaller each day, and changes color to dark brown. Compost is ready when it no longer produces heat.

Source: UC IPM, ipm.ucanr.edu/PMG/GARDEN/FRUIT/ENVIRON/composting.html
Read more about composting at uccemg.com/files/78738.pdf and calrecycle.ca.gov/Organics/

PRUNING BMPS

Poor pruning practices can facilitate the spread of plant disease. For pruning and tool sterilization tips, see UC Riverside's "Best Management Practices for Disease in Oak Woodlands" (Lynch and Eskalen 2014).

TRUSTED COMPOST FACILITIES

It is **recommended** that chipped material be taken to a composting facility that has earned the US Composting Council's Seal of Testing Assurance (STA). Facilities in the STA program are tested for proper decomposition and pathogen control.

Find your local STA Compost Facility at:
compostingcouncil.org/participants

ISHB RESOURCES

Find ISHB research updates and news at:
www.pshb.org
www.eskalenlab.ucr.edu

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