WC-EM-F-10-01: Monitoring oak health and decline before and after infestation by the goldspotted oak borer (GSOB), *Agrilus auroguttatus*

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OBJECTIVES

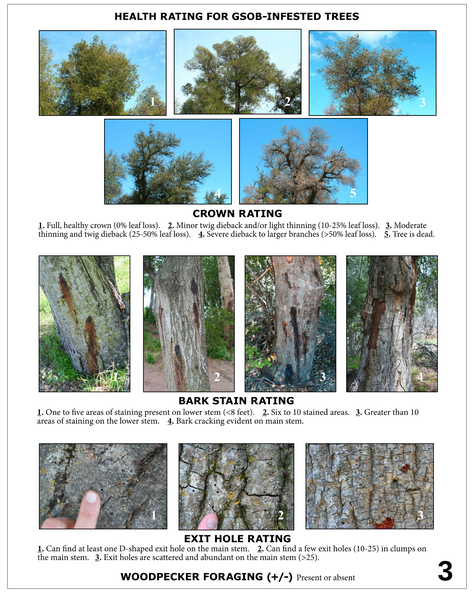
- We proposed to validate a health rating system for GSOB-infested trees by linking visual observations with physiological data. To accomplish this, we:
  1) Monitored the health of uninfested and infested oaks;
  2) Measured beetle success by assessing the density of adult emergence holes;
  3) Monitored GSOB landing rates on uninfested and infested oaks.

- The goldspotted oak borer (GSOB), *Agrilus auroguttatus*, continues to cause elevated levels of tree mortality in southern California (Fig. 1).
- In San Diego Co., tens of thousands of oaks have succumbed to GSOB herbivory and tree mortality has expanded approximately 50 km from the predicted center of the infestation (Fig. 2).

- Determining the time to tree mortality following GSOB infestation and the density of beetles required to kill trees will facilitate management efforts and likely reduce the cost of management and reduce environmental impact by avoiding the use of unnecessary insecticidal and mechanical treatments.

METHODS

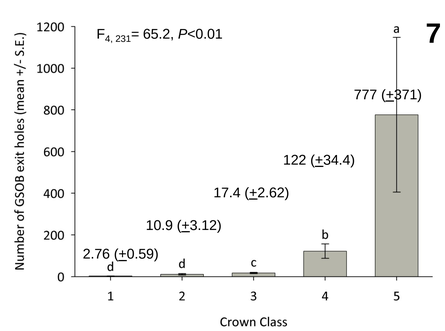
- We assessed oak health and tracked decline of 308 GSOB-infested and uninfested *Quercus agrifolia* in permanent plots on the Descanso Ranger District, Cleveland National Forest.
- Decline ratings were determined by the degree of crown thinning (rating 1-5), bark staining from larval injury (0-4), adult exit hole density (0-3), and presence/absence of woodpecker foraging holes in the outer bark (see Fig. 3). Tree tagging and health ratings began the fall of 2009 and were re-assessed in 2010 and 2011.
- ***Objective 1.*** Soil samples were taken in January, 2011 and again in May, 2011 from the permanent plots to test for the presence of *Phytophthora cinnamomi* in the root zone of *Q. agrifolia*. A total of 49 samples were taken from the four plots.
- Soil was removed from the base of each sample tree (Fig. 4). The holes were dug approx. 1 m from the root collar of the tree. Holes were dug 20-30 cm deep and soil was removed from the bottom of each hole with a trowel.



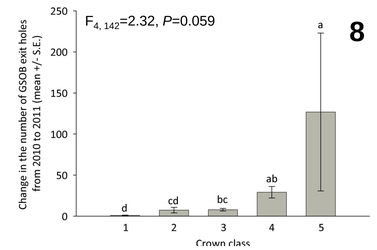
- ***Objective 2.*** To measure beetle success, the total number of D-shaped exit holes were counted and marked (Fig. 5) on the lower portion (<2 m) of the main bole. D-shaped exit holes were assessed across each ranking of crown thinning/die back (1-5) and from 2010 to 2011.
- ***Objective 3.*** In 2011, clear panel traps (30.5x35.6 cm) (Fig. 6) were affixed to 79 of our tagged *Q. agrifolia* across all injury crown classes and spanning several size classes.
- Traps were placed on the north- and south-facing sides at breast height at three of our permanent plots. Trapping occurred from May to September, 2011.

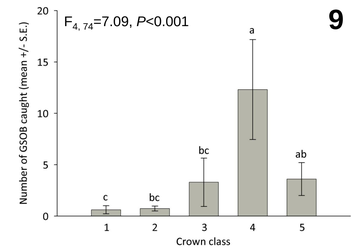
PRELIMINARY RESULTS

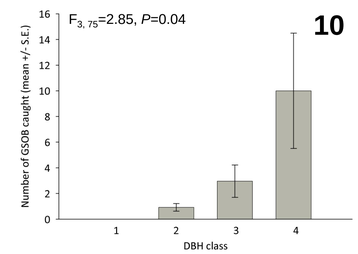
- ***Objective 1.*** None of the soil samples collected from under our tagged infested and uninfested *Q. agrifolia* were positive for *Phytophthora* spp.
- ***Objective 2.*** In 2011, mean GSOB exit hole densities increased with increasing crown thinness (rating 1-5) (Fig. 7).
- Analysis of the mean number of exit holes revealed that trees with ~122 exit holes on the lower bole have a low probability of survival (Fig. 8).
- Exit hole densities vary significantly on dead trees and can be attributed to differences in size classes, contributing factors, and initial tree health.



- Exit hole densities increased across all crown classes from 2010 to 2011.
- The greatest change in exit hole densities was observed on trees killed from 2010 to 2011. D-shaped exit holes also increased on trees with healthy crowns (rating of 1), further suggesting GSOB attacks and can survive in healthy trees.
- ***Objective 3***. Adult GSOB landing rates increased with each crown class designation until tree death (Crown class 5) (Fig. 9).
- Living trees with severe crown thinning showed the greatest landing rates from GSOB and should be considered for removal in high-value sites.
- Adult GSOB landing rate also increased as tree diameter increased (DBH class 1: <10" DBH; 2: 10-20" DBH; 3: 20-30" DBH; 4: >30" DBH) (Fig. 10). No beetles were collected on the smallest oak size class (<10").







SUMMARY

- ***Objective 1.*** *Phytophthora* spp. were not detected in the soil around our tagged trees, which strongly suggests that this pathogen is not a predisposing factor for *Q. agrifolia* in the zone of infestation of GSOB.
- ***Objective 2***. Mean GSOB exit hole densities on *Q. agrifolia* correspond with our current rankings for crown thinness; whereas exit hole rankings could be adjusted to reflect more recent data. Exit hole densities increase with greater crown thinning and can provide an estimate for monitoring GSOB injury levels.
- Trees with a crown rating of "3" or "4" show significant injury from GSOB. These trees can likely not be saved by remedial insecticide applications and should be considered for removal and mechanical treatment to reduce local GSOB populations and prevent spread of this invasive insect.
- ***Objective 3.*** GSOB adult landing rate increased with each crown rating until a crown rating of "4" (the most severe live crown rating). Trees with moderate and severe thinning are very attractive to GSOB adults and should be considered for removal in high-value settings.
- Corresponding with previous data, GSOB prefers landing on larger diameter oaks. Larger size classes should be monitored and treated when preserving high-value sites.

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