Forest Health Protection

Pacific Southwest Region

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2010 International Activities Travel: Goldspotted oak borer and forest health surveys in southern Mexico

(Year 1 of proposed two year project)

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Figure 1. Laguna de Montebello National Park in southern Chiapas. Active populations of the goldspotted oak borer were found in this area.

Summary:

Forest surveys were conducted in the southern Mexican states of Chiapas and Oaxaca for evidence of the goldspotted oak borer (GSOB), *Agrilus coxalis*. The goldspotted oak borer was discovered in each state and in two oak hosts. These are the first known hosts of GSOB in Mexico. Goldspotted oak borer larvae were collected and are being genetically compared to samples from California and Arizona. Forest stand surveys were also conducted at seven sites across the two states where GSOB was historically collected (Fig. 1). Forest composition, oak species and densities, and impact of GSOB were recorded at these sites. Trees were girdled near Teopisca, Chiapas with the hope of returning and finding natural enemies in 2011. Additional forest health surveys were conducted in the same areas for notable insect and disease issues.

Objectives:

1) To survey oak woodlands of southern Mexico for host information and natural enemies of GSOB.
2) Collect forest stand information and determine impact of GSOB in its native region.
3) Conduct forest stand surveys for additional insect and disease issues.

Introduction:

This work would have not been feasible without the assistance of EcoSu, and Mexico's Commission of National Forests (CONAFOR), private land owners, and several community leaders (Fig. 2).

Figure 2. Oak surveys with EcoSur and CONAFOR collaborators in Ocosingo, Chiapas.

Previous GSOB collection history was used to identify locations for ground surveys in Chiapas and Oaxaca, Mexico. Multiple surveys were conducted of the surrounding forests at eight sites. Pine-Oak and evergreen oak woodlands were surveyed for declining and recently killed oaks. Goldspotted oak borer injury symptoms, including crown thinning and dieback, dark staining on the bark exterior, larval feeding patterns, and D-shaped exit holes, were used to identify infested trees.

Objective 1

Surveys were conducted in San Cristobal de las Casas, Ocosingo, Teopisca, Comitan de Dominguez, Laguna de Montebello, and Ocosingo, Chiapas; and Mitla and Ayutla, Oaxaca). These areas represented the most extensive collection history in Mexico and our best opportunity for finding active GSOB populations.

Figure 3. Mature GSOB larve were found in Laguna de Montebello National Park in southern Chiapas.

Oak mortality is occurring at latent levels in these areas. Five oaks were encountered that were dead or appeared in decline across all sites. Conducting forest surveys prior to the monsoon season (late March/ April) proved difficult to focus on declining trees because new foliage had yet to flush-out and evergreen oaks were just beginning to lose last years' foliage. However, this represents the best possible time to find GSOB populations and natural enemies in trees.

This trip was conducted over a two week period from March 28-April 10, 2010. Goldspotted oak borer populations were discovered in an area north of Comitan de Dominguez and Laguna de Montebello, Chiapas; and Mitla, Oaxaca (Fig. 3). Evidence of previous GSOB infestation was found south of Teopisca in a single tree. No additional oak mortality was seen in the immediate vicinity across all sites. Two additional trees did have evidence of GSOB infestation (D-shaped exit holes and larval galleries) at Laguna de Montebello, but the tree appeared to be minimally injured. A total of two oak species were found in Chiapas and Oaxaca to be developmental hosts of GSOB (Fig. 4 and 5). Identification of the infested oak species are still pending.

All dead oaks with GSOB injury symptoms were sampled by shaving away the outer bark and exposing GSOB pupal cells in the phloem. Infested trees were much smaller in diameter than those observed in CA (Laguna de Montebello: 3.9″ DBH, Teopisca: 7.1″ DBH, and Comitan: 8.2″ DBH, and Mitla: 4.2″ DBH). A total of 66 GSOB were sampled from the three trees (Comitan: 61, Laguna de Montebello: 3, and Mitla: 2).

The timing of various GSOB life stages in Mexico is slightly accelerated from what has been observed in California. Mature larvae were primarily found in the outer bark of all trees, but two dead adults were recovered from the Mitla site. An additional adult was sampled from the site near Comitan de Dominguez. One dead larva was recovered from the dead tree at Teopisca. GSOB samples were stored on alcohol and returned to UCR for DNA analyses. Results are still pending from this work, but the larvae have been confirmed as GSOB.

Figure 4. A common oak species found at several sites in southern Mexico that possessed GSOB populations.


Figure 5. The goldspotted oak borer was found to injure this tree species in oak woodlands in Chiapas and Oaxaca.

The same symptoms associated with GSOB injury in California were observed on these oaks in Mexico. Exit hole densities on dead trees appeared less than those infested trees found in California. Injury from GSOB was also found primarily on the lower part of the bole (<6′) of infested trees. No parasitoids were discovered in GSOB-infested trees or on GSOB populations. Ectoparasitoids are common on mature GSOB larvae in Arizona. These same parasitoids were not seen in Mexico. Mature GSOB larvae obtained from infested trees will be dissected for presence of other parasitoids. This work is on-going at University of California, Riverside.

Objective 2

Tenth acre fixed radius plots were established at each site to characterize forest stand conditions and forest health (Fig. 6). Three to five tenth acre plots comprised a site assessment. A total of 25 tenth acre plots were established across the seven sites. Tree species, diameter (DBH), status (living/dead), and stem count was recorded for all species >5” DBH. Trees were identified to genus if species were unknown.


Figure 6. Plot data was taken at all sites visited. Plot data being collected at Huextepec Reserve in San Cristobal.

Average total stand basal area in assessed plots was 74.7 ft^2/ac. Oaks comprised 52% of the total basal area (38.9 ft^2/ac). Average stand densities were 124 trees/acre with oaks making up 58% (72 trees/acre).

Figure 7. A pine-oak woodland north of Comitan de Dominguez, Chipas where GSOB was found.

Oak mortality was limited (0.8 trees/acre) and presence of older standing snags was rarely seen. Evidence of GSOB was primarily found in those recently killed trees. Standing snags are most likely cut from these areas for fuel wood use. Grazing, low-intensity wildfire, and fuel wood cutting appear to dominate the forest management and disturbances regimes in many of these pine-oak and evergreen oak woodlands (Fig. 7 and 8). Some timber management was observed at a pine-dominated site near Teopisca.

Identification of the numerous oak species is still pending. The lack of information about oak species composition, incidence of hybridization, and the diversity of oak species found in this region makes if difficult to identify the numerous oak species encountered. Two pine oak species were encountered with *Pinus oocarpa* being the most prominent.

Figure 8. Oak woodland in Mitla, Oaxaca where GSOB was collected.

Objective 3

We visited an oak-pine site that has experienced oak mortality for several years. This site did not correspond to one of our historical collection records for GSOB, and GSOB was not found at this site. The private landowner informed CONAFOR of the continuing oak mortality. The forest stand was located in Neuvo Palestine in western Chiapas. No significant insect evidence was observed at this site. The site was dominated by oaks with few pines present. *Quercus crassifolia* is the prominent oak species suspected at this site. Eight trees recently died in an estimated eight acre area. Tree mortality was occurring across all size classes. Average DBH of surveyed oaks was 9.0″. Stand densities were relatively high for the dry site, approaching 320 TPA. Bark staining/bleeding was found on several of the oaks in the area (Fig. 9). This could be playing a contributing role in the oak mortality. The staining could be a result of numerous pathogen issues.

An ash (*Fraxinus* sp.) species encountered at Teopisca showed evidence of a *Scolytus* sp. bark beetle (Fig. 10). Three trees were found with evidence of bark beetle injury. The trees were previously injured by human disturbance. Identification is still pending for these samples.

Conclusion

The trip to southern Mexico was very beneficial for providing additional information about GSOB's life history and impact in these native forest stands. Goldspotted oak borer populations collected and plot data assessed will contribute to larger studies to determine where California's population originated and the severity of GSOB's impact in California compared to its native regions (Arizona and Mexico). A second year of funding will be sought to continue surveys for GSOB natural enemies in Chiapas, Mexico and find additional GSOB populations for DNA analysis. If natural enemies are found they will be considered for the biological control program being developed at UCR. Overall, the trip was a great success by providing new collaborators and working relationships, international forestry experience, and valuable data to a new threat to forest health in California.

Figure 9. Staining found at Nuevo Palestine where oak mortality has been occurring at low levels for several years.

Figure 10. Ash (Fraxinus sp.) found with *Scolytus* sp. injury in Teopisca, Chiapas. Identification of the Scolytus sp. is still spending.