60th Annual Meeting of the California Forest Pest Council

If the Forest Could Tweet: California Forest Insect and Disease Updates

Meeting Abstracts

November 15 - 16, 2011

Wildland Fire Training and Conference Center, McClellan, CA

About the California Forest Pest Council (CFPC)

The California Forest Pest Council (CFPC) fosters education concerning forest pests and forest health, and advises the California Board of Forestry and Fire Protection on forest health protection issues. It comprises a diverse group of forestry professionals and others interested in the prevention of damage to forests from insects, pathogens, animals, weeds, and pollution. Meetings are held throughout the State to discuss and evaluate current forest pest conditions. The annual meeting is the most important, providing the membership a chance to review what has happened in the last year, to formulate and vote on resolutions, and to address topics of special concern. Membership in the CFPC is granted to anyone attending. The CFPC is a 501(c)3 non-profit corporation (Tax-ID 94-3248518).

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Meeting Sponsors

The USDA Forest Service, Pacific Southwest Region, State and Private Forestry, Forest Health
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Program of Events Summary

Tuesday, November 15, 2011

9:30 am	Registration
10:30 am	Welcome
10:35 am	2010 Forest Conditions
10:55 am	Special Session: Pesticide Laws and Regulations
11:55 am	Lunch (included)
12:55 pm	Disease Committee Meeting (all are welcome)
2:05 pm	Break
2:25 pm	Disease Committee Meeting, continued
4:00 pm	Poster Session and Social
5:30 pm	Adjourn

Wednesday, November 16, 2011

7:30 am	Registration
8:00 am	Welcome
8:05 am	New and Noteworthy
9:45 am	Break
10:15 am	Insect Committee Meeting – Forest Insects in California (all are welcome)
11:25 am	Managing Firewood
12:00 pm	Lunch (included)
1:15 pm	Managing Hazard Trees
2:15 pm	Break
2:30 pm	Focus on Northwest California Forest Health
3:45 pm	Special Papers
4:30 pm	Adjourn

Oral Presentation Abstracts

(In Agenda Order)

An Update on the Taxonomy, Hosts, and Current Taxonomic Research on Dwarf Mistletoes in California

Robert Mathiasen, School of Forestry, Northern Arizona University, Flagstaff

California remains the state with the most taxa (15) of dwarf mistletoes (*Arceuthobium* spp.). No new species have been described from California since Hawksworth and Wiens published their extensive monograph for the genus in 1996. However, a new subspecies of fir dwarf mistletoe (*A. abietinum*) was described in 2009 from northwestern California (Klamath Mountain Region): *A. abietinum* subsp. *wiensii*. This dwarf mistletoe is a principal parasite of red fir and Brewer's spruce and only occasionally infects white fir.

A morphometric analysis of fir dwarf mistletoe populations from the Sierra Nevada and southern Cascade Mountains has confirmed that there are few morphological differences between red fir dwarf mistletoe (*A. abeitinum* f. sp. *magnificae*) and white fir dwarf mistletoe (*A. abietinum* f. sp. *concoloris*). However, these special forms have still not been observed cross infecting between red fir and white fir.

Only one new host report has been added to the host range data for dwarf mistletoes in California. Limber pine dwarf mistletoe (*A. cyanocarpum*) was found occasionally parasitizing sugar pine in the San Jacinto Mountains near Idyllwild.

My current research projects in California include a molecular analysis of the dwarf mistletoes parasitizing white pines and a detailed morphometric study comparing western dwarf mistletoe (*A. campylopodum*), grey pine dwarf mistletoe (*A. occidentale*), and coastal dwarf mistletoe (*A. littorum*). Preliminary data indicates that these three species are morphologically very similar, particularly western and grey pine dwarf mistletoes, which makes their identification problematic in many pine forests of California.

Expanding the Host Range of the Pitch Canker Pathogen Beyond the Pinaceae: *Fusarium circinatum* as Symptomless Endophyte of Grasses (Poaceae)

Cassandra L. Swett and **Thomas R. Gordon**, Department of Plant Pathology, UC Davis; clswett@ucdavis.edu

Pitch canker is a disease of conifers, mostly pines, caused by the pathogen *Fusarium circinatum*. It is characterized by the production of resinous twig, branch, and trunk cankers, which in California are initiated by entry through wounds made by twig, cone, engraver, and/or bark beetles. In California, pitch canker initially emerged in the 1980s in native Monterey pine forests, with subsequent epidemic-level impacts that dramatically altered the structure of all three native populations. More recently, pitch canker has also developed as a severe disease problem in bishop pine populations in Point Reyes. In a commercial context, pitch canker causes major losses in nursery and Christmas tree production in the state, and is a management concern worldwide in nursery and plantation pine production, especially in the Southeast US, South Africa, Chile, and Spain.

Since its initial description in 1946, the known host range for *F. circinatum* has been limited to species in the family Pinaceae (*Pinus* spp. and *Pseudotsuga menziesii*), and the absence of alternative hosts has been central to developing regulatory measures to restrict movement, conservation strategies for native forests, and disease management methods in commercial systems. However, evidence suggests that the Pineacaea are NOT the limit of *F. circinatum*'s host range. *Fusarium circinatum* is closely related to the grass colonizer *Fusarium subglutinans*, based on inter-fertility between species and phylogenic distance in gene genealogies. If the capacity to colonize grass species (family Poaceae) predates divergence of *F. circinatum* from *F. subglutinans*, *F. circinatum* may have retained this grass-colonizing ability. That grasses have never been found as hosts to this fungus may be accounted for by considering that grass infection of *F. circinatum*, if like *F. subglutinans*, would be symptomless and therefore difficult to detect.

We tested the hypothesis that grass species represent alterative hosts for *F. circinatum* both by screening for infection of diverse grass species collected within infested Monterey pine and bishop pine stands on the Monterey Peninsula and at Point Reyes National Seashore, respectively, and by characterizing endophytic modes of colonization by *F. circinatum* in *Zea mays* (corn).

In field surveys, *Fusarium circinatum* was recovered at high frequency from the grass species *Festuca arundinaceae* and *Holcus lanatus* in Monterey and from *H. lanatus* at Point Reyes. The recovered isolates were pathogenic on pine, and were able to infect *F. arundinacea* as well as four native grass species in greenhouse inoculation trials. Based on characterization of endophytic modes of colonization in corn, *Fusarium circinatum* is capable of colonizing corn roots, stems and developing seed heads (ears) from artificially infested seeds. In addition, ears could become colonized when inoculum was applied to silks and husk wounds, and corn roots were colonized from infested soil. Plants remained symptomless, except in mature ears where kernel rot developed at levels similar to those caused by the corn endophyte and pathogen, *F. verticillioides*.

These results suggest that grass species are alternate hosts for *F. circinatum*, constituting the first documentation of any non-Pinaceae host for this pathogen. Grasses must now be considered as possible cryptic sources of inoculum in both natural and managed systems. There is also potential for grass species to serve as a means for introducing the pitch canker pathogen into new areas. Studies are underway to evaluate these possibilities and to examine the range of grass species that should be included in the host range of *F. circinatum*.

The Semiochemical Saga: Continued Research on Verbenone Plus for Small-Scale Stand Protection

Christopher J. Fettig, **Christopher P. Dabney**[1], **A. Steven Munson**, **Beverly Bulaon**, **Daniel R. Cluck**, **Christopher J. Hayes**, and **Stephen R. McKelvey**

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The last decade has brought national attention to landscape-level bark beetle outbreaks across the western U.S. and Canada. Techniques for managing bark beetle infestations are generally limited to tree removal and insecticide applications to protect individual trees. Both options are labor intensive and costly and may be prohibited in sensitive areas such as riparian zones. In some cases, semiochemical-based tools have been developed and registered to protect trees and/or stands from colonization by specific bark beetle species (Gillette and Munson 2009). For example, the antiaggregation pheromone verbenone (4,6,6-trimethylbicyclo[3.1.1]hept-3-en-2-one) was initially registered by U.S. EPA (licensed for sale and distribution) in December 1999 to control southern pine beetle in southern forests. Since then, the label has been expanded to include mountain pine beetle (MPB) and western pine beetle (WPB) in forests, recreational and municipal settings, and in rights of way and other easements. However, failures in efficacy have been common (confounding factors reviewed in detail in Fettig et al. 2009, specifically in reference to WPB but with applicability to other bark beetle species).

Bark beetles use a variety of contextual cues to interpret chemical messages that influence foraging decisions. These include visual cues such as bole reflectance (Strom et al. 2001), tactile or gustatory cues once in direct contact with host trees (Elkinton and Wood 1980), pheromone or allomone cues from con- or heterospecifics (Byers et al. 1984), and other olfactory cues from intermixing plumes of host and nonhost volatiles. The diverse composition of tree species encountered by most bark beetles during foraging, combined with the high biological costs associated with landing on unsuitable hosts and nonhosts, suggests that bark beetles should be able to discriminate among olfactory cues in order to locate suitable hosts and associated habitats (Shepherd et al. 2007). Based on the semiochemical-diversity hypothesis (Zhang and Schlyter 2004), this seems critical for species like WPB that have narrow host ranges and often forage in mixed forests. In the context of pest management, a diverse array of chemical cues and signals (e.g., Verbenone Plus) may disrupt bark beetle searching success more than high doses of a single semiochemical (e.g., verbenone) or even mixtures of semiochemicals intended to mimic one type of signal (e.g., antiaggregation pheromones), because they represent heterogeneous stand conditions to foraging insects (Zhang and Schlyter 2004, Shepherd et al. 2007). In this presentation, we review the research that resulted in the development of Verbenone Plus for protecting ponderosa pine from WPB attack, and expansion of this novel tool into other systems.

Byers, J. A., D. L. Wood, J. Craig, and L. B. Hendry. 1984. Attractive and inhibitory pheromones produced in the bark beetle, *Dendroctonus brevicomis*, during host colonization: regulation of inter- and intraspecific competition. J. Chem. Ecol. 10: 861–877.

Elkinton, J. S., and D. L. Wood. 1980. Feeding and boring behavior of the bark beetle *Ips paraconfusus* on the bark of a host and non-host tree species. Can. Entomol. 112: 797–809.

Fettig, C. J., S. R. McKelvey, R. R. Borys, C. P. Dabney, S. M. Hamud, L. J. Nelson, and S. J. Seybold. 2009. Efficacy of verbenone for protecting ponderosa pine stands from western pine beetle (Coleoptera: Curculionidae, Scolytinae) attack in California. J. Econ. Entomol. 102: 1846−1858.
Gillette, N.E. and A.S. Munson. 2009. Semiochemical sabotage: Behavioral chemicals for protection of western conifers from bark beetles. In: J.L. Hayes and J.E. Lundquist (compilers), The Western Bark Beetle Research Group: A unique collaboration with Forest Health Protection. Proceedings of a Symposium at the Society of American Foresters Conference. October 23-28, 2007. Portland, OR. 85-109.

Shepherd, W. P., D.P.W. Huber, S. J. Seybold, and C. J. Fettig. 2007. Antennal responses of the western pine beetle, *Dendroctonus brevicomis* (Coleoptera: Curculionidae), to stem volatiles of its primary host, *Pinus ponderosa*, and nine sympatric nonhost angiosperms and conifers. Chemoecology 17: 209–221.

Strom B. L., R. A. Goyer, and P. J. Shea. 2001. Visual and olfactory disruption of orientation by the western pine beetle to attractant-baited traps. Entomol. Exp. Appl. 100: 63–67.

Zhang, Q. H., and F. Schlyter. 2004. Olfactory recognition and behavioural avoidance of angiosperm nonhost volatiles by conifer-inhabiting bark beetles. Agric. For. Entomol. 6: 1–19

Preliminary Results of Monitoring Mountain Pine Beetle Life Cycle Timing and Phloem Temperatures at Multiple Elevations and Latitudes in California

Presenter: **Sheri Smith**, USDA Forest Service, Forest Health Protection
Project leaders: **Barbara Bentz** and **Jim Vandygriff**, USDA Forest Service, RMRS, Logan, UT
Cooperators: **Patricia Maloney** and **Camille Jensen**, UC Davis; **Tom Coleman** and **Amanda Garcia**, USDA Forest Service, Forest Health Protection

The geographic distribution of mountain pine beetle (*Dendroctonus ponderosae*) (MPB) is extensive, encompassing all pine ecosystems from southern California to central British Columbia. In recent years, MPB outbreaks have become longer in duration and populations have expanded their known range, killing pines over millions of acres. This increase in MPB activity is likely related to reduced precipitation, stand characteristics (e.g. age, density), and in some areas, warmer temperatures. California is home to six of the nine white pine species native to the U.S. Many of these are keystone, long-lived species growing at high elevations and are threatened by MPB and white pine blister rust. MPB-related tree mortality has increased over the past decade in multiple ecosystems in California, particularly in lodgepole and whitebark pine. It is anticipated MPB will remain an important disturbance agent in California's forests in the future as droughts are common features of the mediterranean climate, stand conditions favor beetle success, and predicted increases in temperature may also facilitate MPB success.

To describe and predict future trends in population success as a function of temperature, models describing MPB phenology have been developed using data derived from populations in central Idaho. However, little data is available on MPB population dynamics in the southern part of its range, including many areas in California, to evaluate the adequacy of current models. Constant temperature laboratory experiments and range-wide genetic analyses have demonstrated significant genetic and quantitative trait variation among MPB populations from different latitudes, but how this variation relates to population success throughout California is unclear. Baseline data is needed on MPB lifecycle timing to assess potential impacts to high-value pine species and provide a science-based approach for determining management priorities and strategies throughout the State.

We are monitoring phloem temperatures and MPB lifecycle timing on individual trees at multiple elevations, latitudes, and host types to provide an important benchmark for understanding and forecasting the influence of climate on MPB biology. Field-collected data will be also be used to evaluate a mechanistic model for describing MPB developmental timing which can be used to predict susceptibility of California pine forests to MPB-related mortality.

Patterns of Firewood and Forest Pests Brought to California in 2011

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In the last year (October 2010-September 2011), over 18 million pounds of firewood were recorded entering the state by the California Department of Food and Agriculture (CDFA). The Hornbrook, Redwood Highway, and Alturas border stations were the top three entry points. Firewood came from 47 other states, Canada, and Mexico, with 87% of the wood by mass coming from Oregon, California, Arizona, and British Columbia. Most (86%) of the firewood was being taken to a destination in California, and almost half of the remaining wood was being carried to Reno, NV. Firewood in commercial vehicles was expected to travel over twice as far on average than wood in private vehicles: 185 miles versus 87.

Over the same time period, CDFA border stations intercepted 317 potential forest pests. The majority of these (93%) were beetles (longhorned, bark beetles, and wood borers). Almost half of the potential forest pests (44%) were intercepted at the Needles station, followed by the Meyers (15%) and Redwood Highway (10%) stations. Over 90% of the intercepted forest pests were intercepted in private vehicles.

Pests were intercepted in firewood that originated in 36 other states, California, and Canada, with the top origins being Arizona, Oregon, Colorado, and Texas. However, over a quarter of the pests were intercepted in vehicles bearing California license plates. Californians brought firewood containing forest pests back to the state from at least 17 other states. Most of these were in the West but pests were brought back to California from as far away as Georgia and Alabama. Vehicles with license plates from Colorado (9%) and Texas (5%) were the next most frequent.

Nearly all (97%) of the intercepted forest pests were going to a destination in California and there were 122 destinations total. Top destinations were: the Los Angles urban area (31 pests), the San Francisco-Oakland urban area (20), the Sacramento urban area (19), Yosemite National Park and the Riverside-San Bernardino urban area (15 each), Barstow (12), the Victorville urban area (11), and Placerville (10).

An analysis of the factors that best predicted destinations for firewood coming from outside California was conducted. Using logistic regression and Akaike's information criterion, it was determined that out-of-state firewood in private vehicles was more likely to go to areas with higher populations, larger numbers of homes that heated with wood, larger numbers of visitors to public campgrounds, and lower median incomes. Commercial loads of firewood were more likely to go to areas with higher populations, larger numbers of homes that heated with wood, and greater overall truck traffic.

Illusions and Consequences in Tree Risk Assessment: When Law and Arboriculture Collide

Dennis Yniguez, Registered Consulting Arborist & Attorney at Law, Tree Decisions, Berkeley, California

Trained and experienced arboricultural professionals are best equipped to understand the limits of their ability to predict tree failure. How can we influence and create the standards of care that we will be judged by, instead of waiting for the legal system to define for us what is "reasonable?"

At the interface of arboriculture and law, there is considerable friction as our behavior is evaluated and criticized by those who know very little about trees. Some expectations appear to be sensible and well founded, others are unrealistic and irrational.

In this uncertain legal environment, tree risk assessors and tree managers can benefit by understanding the legal concepts by which they will be judged. By knowing what is expected of them, tree professionals can take effective steps to minimize liability exposure for themselves and their clients.

This presentation will review a range of legal concepts that arboricultural professionals are subject to while undertaking tree risk assessments.

Some Legal Concepts That Pertain to Tree Management

- Competence and prudence
- Negligence
- Foreseeability
- Acts of God
- Actual notice
- Constructive notice
- *Res ipsa loquitur*
- Reasonableness

Redefining "Reasonableness"

- Contracts
- Records
- Disclosures and disclaimers
- Duty of care versus standard of care
- Industry standards and guidelines

Black Bear Damage to Conifer Plantations: A Growing Concern for Forest Management in Hoopa and Beyond

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Black bear damage to conifers has been documented in forestry and wildlife literature since at least the 1950s and a great deal of effort has been given to controlling damage throughout the Pacific Northwest. Supplemental feeding has been used in Washington and Oregon with success documented in at least Washington (Ziegltrum 2004). In the state of California it is not legal to feed wildlife and thus no supplemental feeding has been tried. The economic impact of bear damage is challenging to quantify due to the length of time stands remain vulnerable and the quirks of growth models which shift growth from one tree that dies to the remaining trees. In some forest types this shift does not seem realistic due to intense competition from brush and hardwoods and the fact that bears tend to damage the largest, fastest growing trees leaving behind the less vigorous trees.

At Hoopa, black bears have cultural value and are generally not hunted. The population density of bears is subsequently very high throughout most of the reservation. Timber harvest is, however, the single most important means of supporting the tribe's economy and, therefore, the tribe has focused on controlling conifer damage while studying the ecology of the problem using some novel techniques. In the bear damage literature for example, it is often stated that female bears are responsible for the majority of the damage, that the behavior is taught from sow to cub, and that not all bears exhibit the behavior. Using bear hair samples collected from damaged trees and genetic analysis to identify individuals and gender, we have supported those findings for the most part. However, there is more to the story. We witnessed the spread of the behavior from west of the Trinity River to the east. Our genetic samples collected from 2000-2002 fully supported the theory that females are responsible for the majority of the damage (81% of all tree samples were from female bears). As bear damage spread rapidly on the east side of the reservation, we found that 60% of the tree samples were from male bears leading us to speculate that young dispersing males might take the behavior with them. This might then be followed by local females learning the behavior by encountering freshly peeled trees.

Bears are clearly exploiting young trees as a source of food in the spring and damage levels fluctuate from year to year. Fluctuations are likely due to availability of other preferred foods and climatic conditions affecting tree growth and sugar content. We have observed drops in bear damage intensity when spring bear scats have a high frequency of acorns while damage intensity is higher when spring scats lack acorns. Protecting acorn producing trees, actively managing hardwoods to increase mast production, modifying silvicultural practices, and simultaneously controlling the bear population might reduce damage to acceptable levels. Bear tree damage has clear economic impacts, but may have ecological value.

Forest Pathogen Dynamics in Old-Growth White fir/Douglas-fir Forests of Northwestern California

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Native forest pathogens contribute to tree mortality, increase stand structural heterogeneity, and affect tree community composition. Fire suppression has significantly altered conifer forests of California by increasing stand densities and reducing heterogeneity. White fir and Douglas-fir co-occur throughout northwestern California and vary in shade tolerance and regenerative abilities following disturbance. Pathogens were investigated in old-growth white fir/Douglas-fir stands in northwestern California to assess their roles in tree mortality, gap formation, and regeneration. In study sites ranging from 4-10 ha abundances and size class distributions of canopy trees, presence of pathogens, and causes of tree mortality and gap formation were determined. Pathogens including root-rot fungi and dwarf mistletoe accounted for significantly higher mortality and gap formation in white fir relative to Douglas-fir. Important root-rot fungi of northwestern California including *Phellinus weirii* and *Pseudoinonotus dryadeus* will be discussed.

Heart Rot Fungi and Plant Community Composition in Coniferous Forests of Northwestern California

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In old-growth forests, fungal pathogens operate over a background of larger scale abiotic disturbances such as fire and wind storms, affecting forest structure, community composition, and nutrient cycling. Such local disturbances may be scattered across the forest, creating a mosaic of variously sized and aged gaps in an otherwise unbroken canopy. Many of the unique features of very old forests, including multi-storied stands, increased overall biotic diversity, large accumulations of snags and coarse woody debris, as well as associated flora, fauna and mycota are largely the consequence of pathogen activity over time. Without frequent stand destroying disturbances, canopy gaps are formed by the mortality of one or more trees, either through bole breakage (stemsnap) or by uprooting (windthrow).

Heart rot fungi as an ecological group represent a unique type of pathogen. They complete their life cycle in their respective hosts without causing outward symptomology or decline in growth. Ultimately contributing to host mortality through stemsnap, as the bole is weakened by the degradation of the heartwood. This study seeks to describe at the stand level the incidence of heart rot driven gaps and their effect on plant community composition and regeneration in late seral Douglas-fir/white fir alliance forests of Six Rivers National Forest in Northwestern California.

Pityophthorus boycei: A Little Known Twig Beetle

Martin MacKenzie, USDA Forest Service

In 2010, while monitoring Forest Health in the Rock Creek drainage on the Inyo National Forest it appeared that the Whitebark pines (*Pinus albicaulis*) on the West side of the drainage were being killed by the mountain pine beetle (*Dendroctonus ponderosae*) and on the East side of the drainage, along Wheeler ridge, the whitebarks were being impacted by the twig beetle *Pityophthorus boycei*. On maturing whitebark trees along Wheeler ridge 50-70% of branches ended with a dead twig, and although there was evidence of the occasional tree killed by the mountain pine beetle, this insect was not common. The question that was initially asked was, "Is the twig beetle either setting the whitebarks up for the one two punch from the mountain pine beetle, or is the twig beetle damage lowering the food quality of the whitebark to the point that the mountain pine beetle is bypassing them.?"

Preliminary inquiries indicate that *Pinus albicaulis* may be a new host record, plus the Inyo National Forest and the Devil's post pile National Park may be new localities for *P. boycei*, which is best known from Lodgepole pine (*Pinus contorta*).

Perhaps the greatest volume of important bark beetle information and taxonomy was compiled by the late Stephen L. Wood and Donald. E. Bright. M. MacKenzie has, in his office, at least 4,934 pages of their writings. And yet, this scholarly work, containing a massive number of citations, covers the biology of *Pityophthorus boycei* in just 66 words. Obviously this insect deserves more study. As a population of this insect has been known to be infesting a lodgepole stand on the author's forest, it was decided to autopsy 50 infested twigs a month, for 12 months, in an attempt to discover more about this beetle.

Monitoring plots were established on the Inyo National Forest to answer the question relating to the "One, two punch of *Pityophthorus boycei* followed by *Dendroctonus ponderosae."* Initial observations made around Rock Creek Lake seem to support the idea that the outbreak of mountain pine beetle is killing whitebark pines irrespective of the presence of the little known twig beetle. It may be that in its initial attacks the mountain beetle was killing the healthiest white barks and as the outbreak continued it filled in the mortality pockets by killing *P. boycei* damaged trees.