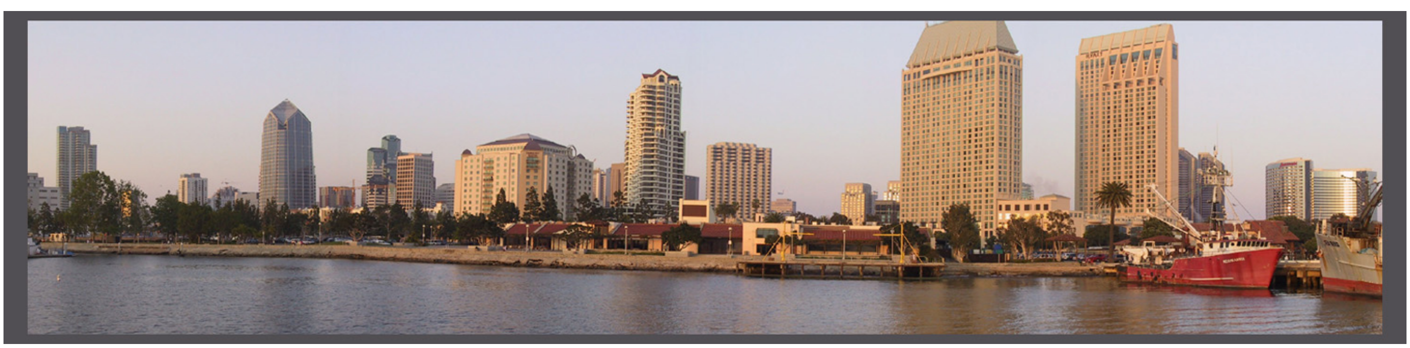
Proceedings
of the
Fifth Joint Meeting
of the
Western Forest Insect Work Conference
and
Western International Forest Disease Work Conference

San Diego, California
April 26 – 30, 2004



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Compiled by:

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Photos provided by Pete Angwin, Ron Billings, Sandy Kegley,
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Proceedings reviewed by Christopher Fettig, José Negrón, and Sheri Smith

In Memorium

Dr. Donald Lee Dahlsten
Professor of Forest Entomology
University of California, Berkeley
(December 8, 1933—September 3, 2003)

It is with great regret that we announce the passing of our good friend and colleague, Don Dahlsten, on September 3, 2003 at the age of 69. Don died at the Alta Bates Medical Center in Berkeley after a two-year battle with a rare form of skin cancer.

Over the course of a 40-year career, Don developed a worldwide reputation as a respected leader in forest entomology and related fields. His research focused on the development of ecologically sensitive methods of managing insects that feed on trees in forest and urban environments. We are all aware of his pioneering work regarding the biological control of eucalyptus psyllids, but Don distinguished himself with research on the population dynamics of bark beetles and the factors that attract their natural enemies. His other projects included research on how the methods developed to control Pierce's disease-impacted riparian habitats, description of the life history and development of control strategies of elm leaf beetles, and the ecological impact of the sudden oak death pathogen, a fungus-like alga that has killed tens of thousands of oak trees throughout California.

Don was a true naturalist and had a deep interest in a wide range of organisms. He maintained one of the largest long-term databases of insectivorous birds in California's forest and riparian areas, and recently contributed a 20-page chapter on the biology of the chestnut-backed chickadee for the encyclopedia "Birds of North America."

Don was known, respected and loved by colleagues around the world. He worked and traveled extensively in France, Romania, Australia, Chile, and Brazil; and was one of the first biologists to work in China following its opening. Most recently, Don was in Mexico assisting in the establishment of an insectary developed to produce parasites of the eucalyptus psyllid.

Don was noted as a dedicated educator and was appointed as Associate Dean for Instruction and Student Affairs at U.C. Berkeley's College of Natural Resources in 1996. He advised 39 graduate students during his tenure, but he also taught literally thousands of natural resource, entomology and forestry students in his popular undergraduate courses. His influence extended far beyond the campus as he often addressed professional and civic groups, and he developed outreach programs through the College as well as through the University of California's interactive University Project.

Don received numerous honors throughout his distinguished career, including the UC Berkeley College of Natural Resources Outstanding Teaching Award in 1995, the UC Berkeley Distinguished Service Award and the College of Natural Resources Citation in 2003. He was perhaps most proud of being named the 2003 recipient of the Western Forest Insect Work Conference Founder's Award for Contributions to Forest Entomology. Don was an ardent participant in both the Western Forest Insect Work Conference and the California Forest Pest Council. He greatly enjoyed these gatherings and served in virtually every capacity in both organizations including Chair, Secretary, and Councilor in addition to his contributions on Special Committees, and as Local Arrangements and Program Chair. Also, let it be not forgotten that he was a multiple recipient of the "Ethical Practices" award given in past times by the Western Forest Insect Work Conference.

To many members of the Western Forest Insect and Western International Forest Disease Work Conferences, Donald Lee Dahlsten was not only a teacher, mentor and colleague but also a dear and special friend. He will be sorely missed.

Tribute Prepared by Patrick J. Shea and Tom Eager and Presented on Tuesday April 27, 2005

ORGANIZATIONAL COMMITTEES

Program Committee

Steve Seybold, Research Entomologist, USDA FS PSW Station, Davis, CA (Co-Chair)
Hadrian Merler, Pathologist, Southern Interior Forest Region, Vernon, BC (Co-Chair)
John Christopherson, State of Nevada, Washoe Valley, NV
Steve Cook, University of Idaho, Moscow, ID
Everett Hansen, Oregon State University, Corvallis, OR
Kathy Lewis, Univ. Northern B.C., Prince George, B.C.
Staffan Lindgren, Univ. Northern B.C., Prince George, B.C.
Jorge E. Macías Sàmano, El Colegio de la Frontera Sur, ECOSUR, Chiapas, MÉXICO
Laura Merrill, USDA FS FHP, Riverside, CA
Steve Munson, USDA FS FHP, Ogden, UT
Jose Negron, USDA FS RM Station, Ft. Collins, CO
Kathy Sheehan, USDA FS FHP, Portland, OR (Webmaster)
Judy Adams, USDA FS, Ft. Collins, CO (Webmaster)

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Sheri Smith, USDA FS FHP, Susanville, CA

Registration

Danny Cluck, USDA FS FHP, Susanville, CA
John Kliejunas, USDA FS FHP, Vallejo, CA
John Pronos, USDA FS FHP, Sonora, CA
Sheri Smith, USDA FS FHP, Susanville, CA
John Wenz, USDA FS FHP, Sonora, CA
Bill Woodruff, USDA FS FHP, Susanville, CA

Field Trip

John Kliejunas, USDA FS FHP, Vallejo, CA
Laura Merrill, USDA FS FHP, Riverside, CA
John Pronos, USDA FS FHP, Sonora, CA
John Wenz, USDA FS FHP, Sonora, CA

Program and Proceedings Organization

Steve Seybold, USDA FS PSW, Davis, CA

Photography

Pete Angwin, USDA FS FHP, Redding, CA
Sandy Kegley, USDA FS FHP, Coeur d'Alene, ID
Mark Schultz, USDA FS, Juneau, AK
John Schwandt, USDA FS FHP, Coeur d'Alene, ID
Bill Woodruff, USDA FS FHP, Susanville, CA
Ron Billings, Texas FS, College Station, TX

Silent Auction

Ladd Livingston, Idaho Dept of Lands, Coeur d'Alene, ID

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Poster Session

WIFDWC

WFIWC

GROUP PHOTOS

Sitting: Jesus J. Guerra, Zhong Chen, Sky Stephens, John Pronos, Jesus A. Cota, Marcus Jackson, Diane Hildebrand, Don Goheen, Fred Baker, David Beckman.
Standing: Bill Jacobi, Mathew Jedra, Carlos Magallon, David Quiroz, Daniel Slone, Brian Aukema, Doug Wulff, Ken Gibson, John McLean.

Sitting: Allison Hansen, John Popp, Dave Overhulser, Stephani Sandoval, Ladd Livingston, Don Owen, Mike Wagner, Karen Clancy, Abby Sirulnik.
Standing: John Dale, Steve Cook, Dwight Scarbrough, Andy Eglitis, Greg Filip, Bruce Hostetler, Tim McConnell, Staffan Lindgren.

Sitting: Dave Wood, Dave Thomas, Bill Riel, Laura Merrill, Bob James, Diana Six, Bill Schaupp, Jill Wilson, Don Owen.
Standing: Terry Shore, Sheri Smith, Peter Hall, Dave Bridgewater, Jim Worrall, Mark Schultz, Andrew Lawson, Steve Dreistadt, John Wenz, Steve Seybold, Tom Eager

Sitting: Eric Smith, John Kliejunas, Blakey Lockman, Everett Hansen, Bill Otrosina, Kathy Lewis, Borys Tkacz, Brian Shirley, John Foltz.
Standing: Lori Trummer, Jim Ellenwood, Pete Angwin, Gregg DeNitto, Brytten Steed, Terry Rogers, Bob Cain, Jeri Lyn Harris, Dave Schultz.

Sitting: Ellen Goheen, Judy Adams, Lorraine MacLauchlan, Leo Rankin, Helen Maffei, David Shaw, Tim Paine, Dezene Huber, Chris Fettig.
Standing: Pat Shea, Hadrian Merler, John Browning, Mike Albers, Dan Gilmore, Will Littke, Detlev Vogler, Andrew Storer, Richard Reich

Sitting: Darrell Ross, Martin MacKenzie, Robert Gilbertson, Celia Gilbertson, Larry Meyer, Sheryl Costello, Michele Eatough Jones, Shiroma Sathyapala, Ron Billings.
Standing: Danny Cluck, Nadir Erbilgin, James T. Blodgett, Dennis Haugen, Mary Ellen Dix, Kerry Britton, David Leatherman, John Nowak, Christopher Dabney, Bill Woodruff.

David Wakarchuck, Bruce Thomson, Cam Oehlschlager, Brian Sullivan

PROGRAM

Program: Fifth Joint Meeting of the Western Forest Insect and Western International Forest Disease Work Conferences, April 26-30, 2004, San Diego, California

Monday April 26

Arrival of attendees in San Diego

1:00-7:00 PM—Meeting registration *(Pacific A/B Foyer)*
1:00-5:00 PM—WIFDWC-Western disease steering committee meeting (*Porthole Room*)
1:00-5:00 PM—WIFDWC-Nursery pathology meeting (*Bay Room*)

[2:00-5:00 PM—Pre-Meeting Field Trip of Port of San Diego Otay Mesa Cargo Facility - Insect and Pathogen Detection-Office of Homeland Security Meet at Hotel Lobby. Contact: Ellen Goheen]

Meeting Registration

4:00-5:00 PM—WFIWC executive business meeting (*Embarcadero Room*)
5:00-6:00 PM—WFIWC full business meeting (*Embarcadero Room*)
7:00-9:00 PM—Mixer *(Harborside Room)*

Tuesday April 27

7:00-8:00—WIFDWC Rust Committee Breakfast (*Bay Room*, B. Geils)
8:00-9:30—**Plenary Session 1** (*Pacific A/B*)

Welcome to San Diego -- Sue Mason, San Diego Visitors and Convention Center
Organizational Welcome and Local Arrangements: Sheri Smith, USDA FS, Region 5

Keynote Address: Forest Health Issues in California: Where Have We Been and Where are We Going?
Mark Stanley, Chair, California Oak Mortality Task Force, and Asst. Dept. Director (Retired), California Department of Forestry and Fire Protection.

9:30-10:00—**Break**

10:00-11:30—**WFIWC and WIFDWC Plenary Sessions**

WFIWC Plenary Session
(*Pacific A/B*)

WFIWC Founder's Award Presentation:
A Tribute to **Don Dahlsten**
K. Gibson, Chair WFIWC Founder's Award Committee; L. Caltagirone, L. Brennan, T. Eager, and P. Shea, speakers

WFIWC Student Award Presentation (Darrell Ross, presenter):
Awardee: **Brian Aukema**, Univ. of Wisconsin-Madison:"Impacts of predators on population dynamics and behavior of bark beetle prey: Implications for biological control"

WIFDWC Plenary Session
(*Pacific C*)

2003 Outstanding Achievement Award Address—**Everett Hansen**

2004 Outstanding Achievement Award Presentation—G. Filip, D. Goheen, and S. Zeglen

Regional Status Reports—E. Goheen

11:30-1:00—**Lunch**

[11:30-1:00—WIFDWC Hazard Tree Committee Lunch (*Bay Room*, J. Pronos)]

1:00-2:30—**Concurrent Workshops Session 1**

Current status of entomological and pathological research in the national fire and fire surrogate (FFS) study *(Pacific A/B)*
(C. Fettig, USDA FS Davis, CA and W. Otrosina USDA FS Athens, GA, co-moderators)

Induced insect and disease resistance in trees: Scientific curiosity or application of the future?
(J. Bohlmann, Univ. Brit. Columbia and P. Bonello, Ohio State Univ., co-moderators) *(Pacific C)*

Development and status of the US Forest Health Monitoring Program *(Porthole Room)*
(B. Tkacz, USDA FS Washington, D.C., moderator)

Disease and insect issues associated with the spruce-fir type in the Rocky Mtns.
(J. Negron, USDA FS Ft. Collins, CO and F. Baker, Utah State Univ., co-moderators) *(Embarcadero Room)*

2:30-3:00—**Break**

3:00-4:30—**Concurrent Workshops Session 2**

The national strategy on invasive forest insects and diseases *(Pacific A/B)*
(D. Thomas, USDA FS, Washington, D.C. and B. Illman USDA FPL, Madison, WI, co-moderators)

Wood-destroying organisms in the new millennium: Where have we gone since Bend 1989?
(M. Haverty, USDA FS, Albany, CA and Jessie Micales USDA FPL, Madison, WI, co-moderators)
(Embarcadero Room)

Evolutionary aspects of forest insect-fungus interactions *(Pacific C)*
(K. Klepzig, USDA FS, Pineville, LA, moderator)

Bugs, basidiospores, and fiber: The role of silviculture in maintaining healthy forests
(D. Gilmore, Dept. of For. Resources, University of Minnesota, moderator) *(Porthole Room)*

Wednesday April 28

7:30-5:30—**Field Trip**: Disease, insect, and fire issues around Laguna Mountain, Cleveland National Forest, San Diego Co. (Laura Merrill, John Pronos, John Wenz, co-organizers)

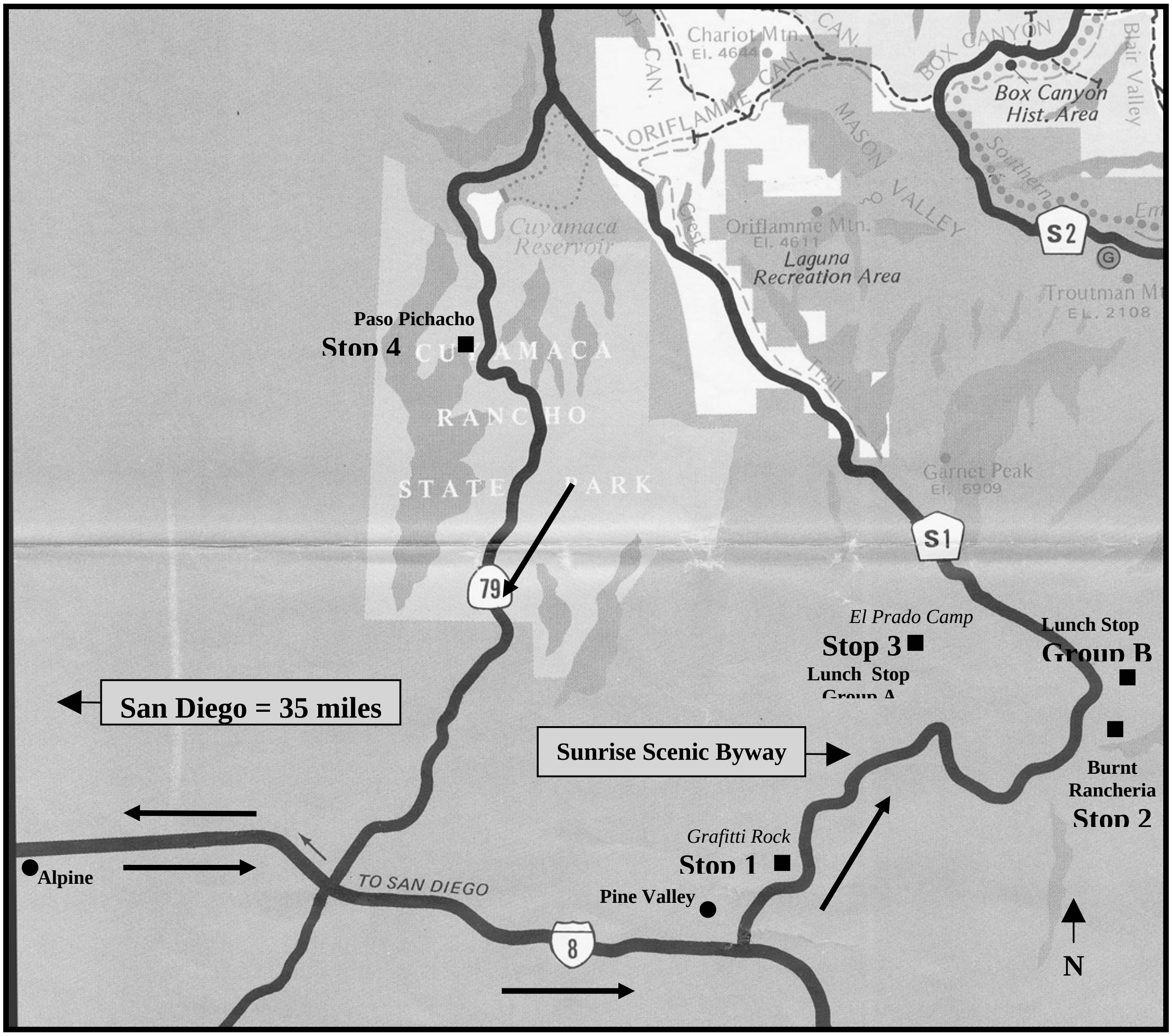
Two buses (Group A) will leave the Holiday Inn at 7:30 AM and two buses (Group B) will leave the Holiday Inn at 8:30 AM. Both buses will participate in the same program; Group A will have lunch at Laguna Campground (El Prado), whereas Group B will have lunch at Desert View Picnic Area. Each stop and the lunch break will last about one hour. Group A will return to the Holiday Inn at about 4:30 PM and Group B will return about 5:30 PM.

Registration sheets for each group will be available at the registration desk.

STOP	SUBJECT	SPEAKERS
#1 – Graffiti Rock	- Descanso RD resource management issues Background- Cedar Fire	Tom Gillett
	- History of pest management in SoCal/ Laguna Mtn.	Laura Merrill
#2 – Burnt Rancheria Campground	- Jeffrey pine beetle	Tim Paine, Diana Six
	- Dwarf mistletoe and hazard tree management	John Pronos, Nancy Hoogerland
#3 – El Prado Campground	- Wood borers, *Ips* spp., risk rating systems	Dave Wood
	- Annosus root disease	John Kliejunas
	- Dwarf mistletoe pruning research	Bob Scharpf
#4 – Paso Picacho Campground	- 2003 Fires: Fire ecology, management and restoration	Rich Minnich Jim Dice- Cuyamaca Rancho SP

Wednesday April 28

2004 WFIWC/WIFDWC Field Trip, Laguna Mountain, Cleveland National Forest



The trip will start at the Holiday Inn in San Diego, proceed east on I-8 to the Sunrise Scenic Byway, north along this scenic road to Hwy 79, south on Highway 79 through Cuyamaca State Park to I-8 and return to the Holiday Inn.

Wednesday April 28

7:00-9:00 PM—**Poster Session**—including a silent auction for the WFIWC Memorial Scholarship Fund (L. Livingston) and "sweet treats." (S. Smith, D. Cluck, H. Kearns, and L. Livingston, Poster Session Organizers)
(Pacific A/B)

Thursday April 29

7:00-8:00—WIFDWC Dwarf Mistletoe Committee Breakfast (*Bay Room*, F. Baker)

8:00-9:30—**Concurrent Workshops Session 3**

Renewed research efforts on the application of verbenone and other semiochemicals for reducing bark beetle-caused tree mortality
(C. Fettig, USDA FS, Davis, CA, moderator) *(Pacific A/B)*

What's new in graduate school? Research presentations by students in entomology and pathology (T. Eager, USDA FS, Gunnison, CO, moderator) *(Embarcadero Room)*

Pathological issues regarding broadleaf hosts
(W. Littke, Weyerhaeuser Res. Stn., Federal Way, WA, moderator) *(Coast Room)*

Multistate Research Project W-187: An example of an integrated approach to studying the impacts of insects and diseases in forest ecosystems.
(B. Bentz USDA FS, Logan, UT and D. Six, Univ. of Montana, Missoula co-moderators) *(Porthole Room)*

9:30-10:00—**Break**

10:00-11:30—**Concurrent Workshops Session 4**

Biological control and forest pest management:
A tribute to Donald L. Dahlsten
(R. Luck, Dept. Entomology, UC-Riverside & S. Salom, Dept. Entomology, VPI, co-moderators)
(Pacific A/B)

What's current in forest pathology in western North America
(K. Britton, moderator) *(Coast Room)*

11:30-1:00—**Lunch**

[11:30-1:00—WIFDWC Root Disease Committee Lunch (*Bay Room*, E. Goheen)]

Thursday April 29

1:00-2:45—**Plenary Session 2** *(Pacific A/B)*

Interactions of air pollution with forest health
M. Eatough-Jones and **T.D. Paine**, co-organizers

Introduction: Timothy Paine, Department of Entomology, University of California Riverside

Nitrogen deposition to western forests: sources and impacts, Abby Sirulnik, Department of Botany and Plant Sciences. University of California Riverside

Physiological basis of ozone injury in pine, Nancy Grulke, USDA Pacific Southwest Research Station, Riverside, CA

Tree diseases and mortality in California forests impacted by ozone, John Pronos, USDA FS FHP, R5, Sonora, CA

Air pollution and insect herbivore communities, M. Eatough-Jones, Department of Entomology. University of California Riverside

2:45-3:15—**Group Photos** (R. Billings and B. Woodruff, Photographers)

3:15-4:15—**WFIWC Final Business Meeting** *(Pacific A/B)*

3:15-4:15—**WIFDWC Special Papers** *(Coast Room*, W. Jacobi, Moderator)

3:15—R. Reich: Hyperspectral detection of the green attack stage of mountain pine beetle in BC.
3:35—J. Worrall: Fire regime condition classification: A new assessment method for federal lands and its relationship to forest health.
4:00—K. Fields: Impact of Armillaria and Annosus root diseases on stand structure and down woody material in a central Oregon mixed-conifer forest.
4:15—H. Maffei: Predicted and measured 10 year impacts of Armillaria root disease on forest structure, density and fuel loading.

4:15-5:15— **WIFDWC Final Business Meeting** (*Coast Room*)

4:30—Fun Run (John Anhold, Organizer) or On Your Own
6:30-9:00—Banquet and Social Evening (*Harborside*)
6:30: No Host Bar; 7:00 Dinner

Presentation: "Have Camera, Will Travel: A Selection of Scenic Slides by Ron Billings."

Friday April 30

7:00-8:00—WIFDWC Nursery Pathology Committee Breakfast (*Bay Room*, D. Hildebrand)

8:00-9:30— **Concurrent Workshops Session 5**

Insect and disease issues associated with oaks in California
(P. Shea, USDA FS Davis, CA and D. Rizzo, UC-Davis, co-moderators) *(Pacific A/B)*

Disease, insect, and management issues associated with the pinyon-juniper type in the West
(B. Steed, USDA FS Ogden, UT and W. Jacobi, Colorado State Univ., Ft. Collins, CO, co-moderators)
(Coast Room)

Bark beetle prevention programs: New approaches and progress (R. Billings, Texas Forest Service, Lufkin, TX, moderator) *(Harborside Room)*

Current research on sucking insects in North America
(A. Lawson, Fresno State, moderator) *(Porthole Room)*

9:30-10:00—**Break**

10:00-11:30—**Plenary Session 3 (Conference Finale)** *(Pacific A/B)*

> Plenary Address: Ronald P. Neilson, Dept. of Botany and Plant Pathology, Oregon State University, "Climate change and vegetative responses."
>
> Moderated Discussion: Everett Hansen, Oregon State University, Moderator

11:30-1:00—Lunch (on your own)

1:30 PM—Golf Tournament (Phil Mocettini and Tim McConnell, Organizers)

Chairperson's Opening Remarks

Good morning and welcome to the Fifth Joint Meeting of the Western Forest Insect Work Conference and Western International Forest Disease Work Conference.

My name is Steve Seybold with the USDA Forest Service Pacific Southwest Research Station and I am one of two Co-Chairs on the Program Committee for the meeting. Hadrian Merler of the B.C. Provincial Forestry Service is the other co-Chair. Our committee has worked hard to develop a program that we believe illustrates the integrated nature of forest entomology and pathology in modern forest health issues. This theme should be evident from our plenary sessions to our workshops, field trip, and poster session as you will find that wherever possible we have partnered up experts in forest entomology, pathology, and other disciplines to help us discuss and understand new approaches and complex problems.

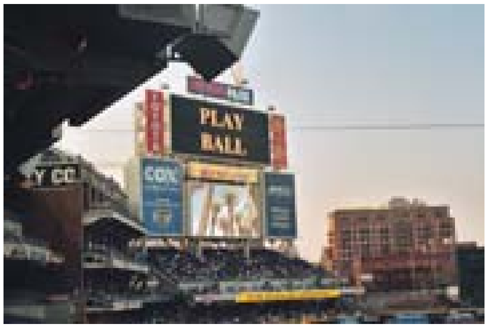
As you glance through the program I think that you will see that although the meeting has a particularly western flavor, we have also tried to address issues that are relevant and interesting to the forest health professionals throughout North America. We hope to take a broad view this week as we learn the latest about the Fire and Fire Surrogate Study, the Forest Health Monitoring Program, Multistate Research Project W-187, and the US National Strategy on Invasive Insects and Fungi. We want to thank our colleagues from work conferences in the northeastern, north central, and southern regions for joining us and bringing a broader, national perspective to this meeting. We should also note that this meeting will host a gathering of our foremost North American experts in wood products entomology and pathology, and that this marks a 15 year anniversary of a similar gathering in Bend, Oregon.

Finally, I want to acknowledge the efforts of our California forest health professional community for rising to the challenge of hosting this meeting and leading its activities. I want to especially mention the efforts of Sheri Smith, our local arrangements Chair, who has worked tirelessly on the preparation for the meeting. We have also had superb leadership in planning and organization at the workshop, field trip, and plenary session levels from the other USFS R5 forest health protection specialists, USFS PSW scientists, State of California forestry professionals, and academic scientists from UC-Berkeley, Davis, and Riverside. At the State level, Mark Stanley, who is the former deputy director of the California Department of Forestry and Fire Protection, will soon provide an overview of the forest health challenges California has faced in recent years, particularly with the arrival of exotic diseases such as pitch canker and sudden oak death.

Thanks to all of our California forest health crew in advance and thank you to my co-Chair, Hadrian Merler and the rest of the Program committee.

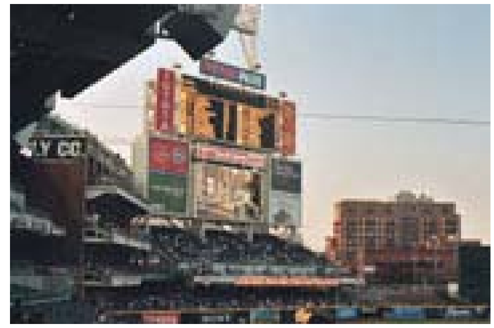
So, I welcome you all to San Diego to enjoy this beautiful venue and what we hope will be a very stimulating meeting. I encourage you to take time out from the organized activities to meet informally with your professional friends and colleagues and to enjoy the scenery and sights around you. Don't ditch all of our sessions, but be sure to have some fun here in town!

To help you appreciate what you will see around you this week, I would like to introduce Sue Mason, representing the San Diego Convention Center and Visitors Bureau, who will make us all aware of all of the wonderful things that San Diego has to offer.



Petco (San Diego Padres) Stadium


Baseball fans Bill Schaupp, Ralph Thier, and Jim Hoffman


Petco (San Diego Padres) Stadium


Esmeralda Chilean ship


Esmeralda flags


Ladd Livingston at silent auction


"The Surprise," used in the film *Master and Commander*


Ferry to Coronado Island

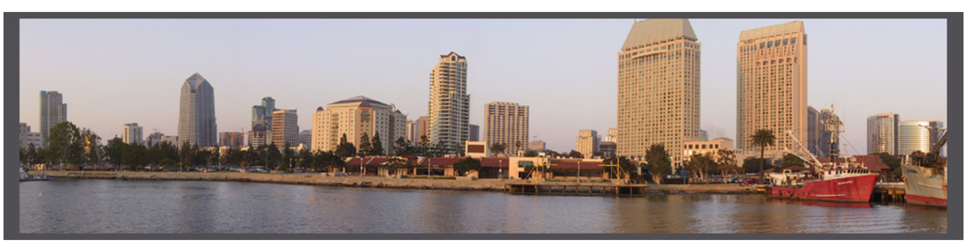

Bill Schaupp, Mark Schultz, and John Dale storm the bar


Coronado Island beach


"The Surprise," used in the film *Master and Commander*


Flowering tree

Plenary Sessions



PLENARY SESSIONS

Plenary Session I
Keynote Address

Forest Health Issues in California: Where Have We Been and Where are We Going?

Mark Stanley
Chair, California Oak Mortality Task Force

It is an honor to be asked to speak to this group. I have heard about your meetings and the group for the last few years from some of the people that I have been working with and it is great to have the opportunity to talk to you this morning.

A little about my background: I am currently the Chair of the California Oak Mortality Task Force. Prior to that, I worked for the CDF for 30 years in a variety of positions from an engine captain to a forester on our largest state forest in Northern California to a long time in a forest products utilization and marketing program. I had the opportunity to coordinate the economic side of President Clinton's Forest Plan for California and to coordinate the Tahoe REGreen program to remove dead and dying trees in the Lake Tahoe Basin. I retired as the Assistant Deputy Director for Resource Protection and Improvement where I was responsible for forest pest program, cost share programs, urban forestry, state forests, nurseries, and about anything that had to do with resource management.

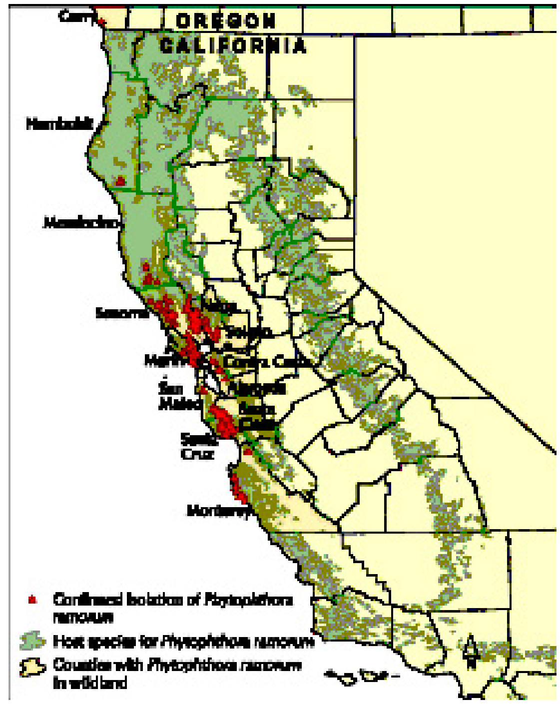
While in this role I had the opportunity to work with very diverse and often very contentious groups. Individuals that either came together willingly, or more commonly were put together and each wanted to get their own way.

Because of this experience I was asked to get involved with the formation of a group that is now known as the California Oak Mortality Task Force. I will talk more about this later.

When Steve called me and asked me to speak I told him that I would like to cover a couple of things. One item is a short update on the status of Sudden Oak Death at a national level, as you will have the best talking to you in the session on Friday. A second item is the general bark beetle problems here in California, specifically San Diego, Riverside, and San Bernardino Counties. Again Don Owen will be talking about this in more detail later in the week, so I don't want to detract from Don. What I want to share with you in more detail is different way of doing business.

Sudden Oak Death update:

Dead tanoak in Big Sur (Monterey Co.) *above*



Currently regulated counties and confirmed wild land infections *(red triangles)*.

In August of 2000 when the task force was formed there were six known hosts, six infested counties in California, one nursery in Santa Cruz and a possible link to Germany. Now we have 60 confirmed or associated hosts, in 12 counties in California, also in southern Oregon. Nine states with confirmed nursery positives, many European countries and hundred of nurseries in the United Kingdom. Things have changed, and will probably continue to change.

Sudden Oak Death

2000	2004
6 hosts	60 hosts
6 counties	12 counties
1 nursery	2 states wild land
1 state	9 states with nursery positives
Germany	Hundreds of nurseries worldwide
	Multiple countries

The bark beetle problem in southern California:

For many years now there has been a fire problem in California. This is particularly true in southern California in the fall when the Santa Ana winds begin to blow. We have, as has the Forest Service and every other fire agency, encouraged, cajoled, coerced, required, or whatever else we could do to have people remove brush and fuel (trees) from around their homes. Most people see trees as trees, and not as fuel or breeding grounds for insects and other pathogens, but as privacy screens, solitude or maybe members of the family. In most cases people that were building homes in the mountains were escaping the city and wanted privacy and the feel of the great outdoors. That means that trees were only removed to build the house, and decks were built around the trees. This is not unique to California, but what is unique, is the fire weather we get and the numbers of homes that were being built in this environment.

I am sure that the homeowner was thinking, what's to worry about? They were protecting the trees by not cutting them down and the Forest Service and CDF and county fire folks would always be there to protect them from fire.

Well, a combination of drought, smog, paving, construction, etc. partnered up to put those trees at risk and the events occurred that led to the bark beetle infestation that we see now. My phone in Sacramento started ringing daily demanding that we remove all the infested or dead trees. After all, we were the forestry department and they were trees, and they were also now recognized as a fire problem. The very people that would not listen to us about removing trees during construction or suggestions for maintaining tree health had now found religion. And it was now "our" responsibility to act. They didn't care that we don't have money, crews, or the responsibility to remove their trees, because they now posed a threat to them. I was also repeatedly told that we had to get the Forest Service to cut all their trees down because the National Forest was obviously the breeding ground for the bark beetles. These were probably some of the same folks that would have been laying down in front of the bulldozers if the Forest Service had planned a forest heath project to thin an overstocked stand to try and improve stand health.

A Mountain Safety Task Force was formed in the fall of 2003 to address the problem and it was patterned after the California Oak Mortality Task Force. The focus was to get money to remove trees. Unfortunately there was little state money readily available and so the federal agencies became their target. It also became clear that the trees would not be removed quickly so they came up with an escape plan as a priority for folks should the unthinkable happen, a fire in the area.

You will see some of the aftermath on Wednesday from the Cedar Fire that erupted in October 2003. In the last week of October of 2003, southern California experienced the most devastating wildland/urban interface fire disaster in its history. According to the California Department of Forestry and Fire Protection, a total of 739,597 acres were burned, 3,631 homes were destroyed and 24 lives were lost, including one firefighter. The aftermath of the fires saw even greater loss of life wherein 16 people perished in a flash flood/mudslide in an area of San Bernardino County due to the loss of vegetation as a result of the fire.

The problem is not over. There are still hundreds of thousands of acres of dead fuel and the bug populations are still there so there will continue to be more mortality. I wish I could say that the fire weather that we had last year was a freak occurrence. Unfortunately it was not. There will be similar conditions this year also and all it takes is an errant spark, lightning bolt, careless hiker, or an arsonist, to see the same scenario happen all over again.

So what good will the Mountain Safety Task Force do? It will promote coordination between agencies and groups to deal with issues that cross jurisdictions, boundaries, and responsibilities. It will not be able to magically remove all of the trees or even stop the trees from being attacked by bark beetles. It may actually be too late for this epidemic short of possibly reducing the loss of life and maybe getting out in front of this somehow.

Homes intermixed with mature and now dead and dying trees.

A different way of doing business:

I would like to share with you a new way of doing business that seems to work. I have seen it work with some of the most difficult and contentious people, groups, and agencies. It is not easy, as most change isn't. It is much easier for people to say, it's too much work, it just won't happen, or one that I have heard for over 20 years. People fall back on logic. When asked why you don't do things a different way we rationally think that if that easier, simpler and more logical way of doing business was not already in place, then it either didn't work because someone before us had tried it, or there were things that prevented it from happening. Therefore, because it was not being done, it is not possible to do it.

I am here to tell you that, it is possible. It's not easy, and it takes people that are willing to work at it together for the common good.
It takes a number of things to have this new approach work.

1. You need a few people who can, and more importantly, want to work as a team.
2. You need those few folks who are leaders and you need at least one person with some clout.
3. You may need to work with some legislative types or at least their staffers.
4. You have to give up personal credit for any of the accomplishments of the group.
5. You will have to trust the other members of the team.
6. You have to have a logical plan to accomplish your goals.
7. YOU WILL HAVE TO NARROW WHAT YOU WANT TO ACCOMPLISH TO WHAT EVERYONE AGREES WITH!!!!!!!!!!

8. Most importantly the decisions have to be that of the group. You may have an idea of where you will need to go or what needs to be done but it has to be a group decision. This will take longer than you would like. Agreements from the group for support of the decision have to be talked about and not assumed.

You need a few folks that have a vision of a workable plan who are willing to do a lot of behind-the-scenes work initially and willing to do a lot of handholding and coaching. You have to have ALL the key players at the meeting in the beginning. You will have to go with the ebb and flow of the group, but still give some gentle direction toward a workable solution for the new organization.

Example: ICS (Incident Command System) vs. task force. Most emergency response agencies work under some kind of ICS system where there are incident commanders, division group supervisors, safety officers, liaisons, etc. This system works and works well in an emergency situation or even in a system where there is a short deadline. It is difficult to use over a long drawn out time frame where money is not endlessly available to address the threat.

When you work with scientists, researchers or non-emergency personnel the terminology can get in the way. I think of George Carlin as he talks about the contrast between football and baseball. You kick the football through the goal posts or break the goal line. In baseball you are rounding third and going home. In football you tackle or knock him off his feet, in baseball to tag him out or drift over to catch a fly ball. They are both games but the terminology for baseball is kinder and gentler that football and therefore appeals to a different audience.

At our first organizational meeting of the task force, we heard a lecture for about an hour that laid out the ICS system by a Chief in the fire service that was instructed to organize this effort under ICS. The group saw org charts and heard all about the incident commanders or the unified command and the division supervisors, etc. Finally one practitioner from the group got up and stated emphatically that "We are not about to be commanded by anyone." Silence fell on the crowd and the chief (incident commander) had no response. After all, he was the commander and all were supposed to follow. The silence became uncomfortable so I got up and said OK, what do you want if you don't want the ICS system. Out came a picture of a beautiful oak tree with a main stem and lots of branches. Some of the folks had already gotten together to discuss this and already had a plan. They wanted to have branches and committees and working groups and a board of directors, not and incident commander, division boss, operations section chief, etc.

So we set up a task force with a number of directors that represented the main and critical players in the solution from a regulatory, resource, and knowledge perspective. At the time we had representatives from CDF, FS, California Dept. of Agriculture, UC research (Entomology and Pathology), and private sector land manager. We developed committees around the main areas of concern and found the main people to chair and eventually co-chair the committees.

This was in August of 2000. Dave Rizzo (UC Davis) and Matteo Garbelotto (UC Berkeley) had just identified the pathogen believed to cause the problem. This was in the news and people were demanding that something be done to "cure" the trees. After all they were their prized possessions and they were now a fire hazard or may fall on their houses.

We scheduled the first meeting of the task force and invited everyone who wanted to be a part of the group from researchers and agency people, to homeowners. We had in the neighborhood of 250-300 people there. Each committee chair made a short PowerPoint presentation about what they and their committee had in mind. A recruitment speech if you will. All the members of the task force made a presentation or were part of the presentation.

We did another thing. We made a template with the task force logo that everyone used as the background for his or her presentation. It was subtle, but to the audience it gave the group an air of unity, professionalism, and organization, an organization that they might want to be associated with.

The committee chairs then went to different corners of the room to talk to those that were interested in joining their committees to see what they could do in their specific interest area. We organized as a subcommittee of the California Forest Pest Council and therefore became a non-profit that you could give money to.

We had very quickly developed credibility with the legislative staffers, with agencies, and the media, and were able to respond quickly to information requests because we had all the principals around the table.

Research at the University of California had developed a needs list for funding and research with some numbers tied to it. This was done before the task force was formed.

I can remember sitting at my desk and getting a call from a legislator in Washington D.C. asking how much money we needed. He was calling me not the other way around. He needed the number in one hour. It was now or never. I made one phone call and we developed a budget with some numbers around our committee structure. Research was a key component. We needed to know what this pathogen was and its epidemiology before we could figure out how to combat it.

I gave him the dollar figure and the crisis was over, or so I thought. The next day he called back and wanted the backup documentation for the numbers, particularly the research as that was in the 1 million dollar range. We had that information and the rest has been history. We have tried as a group to think about the issues before they occur and discuss the options, both pros and cons. So that when asked at a legislative hearing by a brilliant legislator "have you thought about….". You can intelligently discuss that and move on. That impresses them that this group has been planning and is working together. Another very strange thing happened at the state budget hearings. The people that testified in favor of the funding among others were the California timber industry, California Farm Bureau and the Sierra Club. All in support! One of the legislators asked, "Who is against this Bill?", and the response was no one. In disbelief she said, "What about the environmental community"? The Sierra Club had just given their support. Legislators could not add their names to the bill as co-authors fast enough. Something with no opposition to it? Where do I sign!?

Coordination seems like a simple thing. Send a few emails here and there and maybe a phone call once in a while. It takes lots of care and feeding to maintain this kind of a group. Media representatives will call and you need to be able to respond to them even though you may not want to. Dealing with the press is not always a pleasurable experience. You will have to work with the all the various agency public information officers and if possible have one be the lead person that will work closely with the various agencies and groups for quotes and give the all important credit. Again this is no small task.

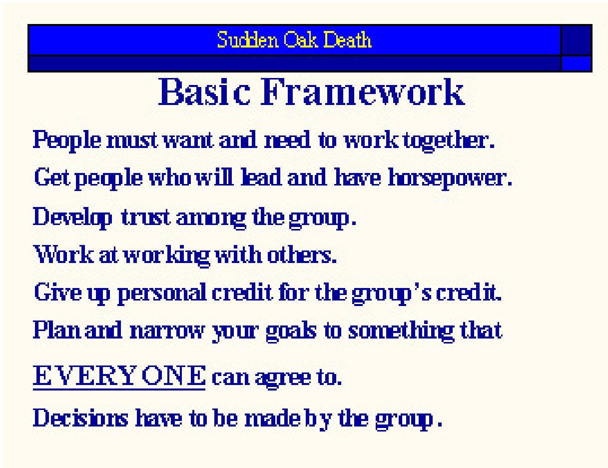
You will and should develop a list of goals or things that you want to accomplish. Develop two or three main messages or issues and projects that you want to focus on. This is important for a number of reasons:
1. Everyone involved will be able to focus on what the group wants to accomplish.
2. The group can speak with one voice on those issues are most important and EVERYONE has agreed to work together on.

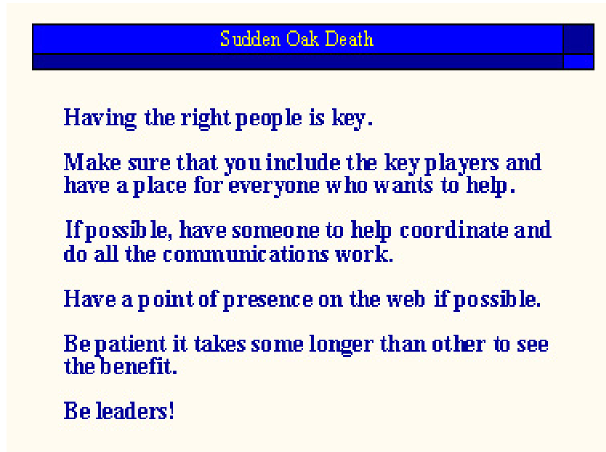
It is critically important to get one or more "quick wins" to reinforce the value of being involved with the group. It may be getting some initial funding or as simple as having someone else deal with the press, at least initially. This is very important, because in the beginning it will seem to take longer to get things done as a group than if you just did it yourself. You will have to develop trust between the primary group members. It will get to the point where as you communicate concerns from your agency, group or department, then you and others in the group will also communicate the concerns from the entire group.

Research is where we really did things differently. Funding came from the University of California, from the USDA Forest Service, State and Private forestry, and from research and from the State of California through the task force. How things normally worked in the past is that everyone would do an RFP and fund their projects. We took a different approach. Between Forest Service research (the Pacific Southwest Research Station), the University of California, and the task force we brought together those who were not only already working on the problem but those that had to deal with the problem in the field. We put together what was already going on and then identified the holes and the areas of critical need. Then, a single focused RFP was developed to try and get researchers to specifically answer those questions. This was not what a lot of folks in the research community were used to, or wanted. Instead of saying I have money tell me what you want to do, we said we have money and this is what we want to know. Another change was that instead of me doing an RFP and Pat Shea doing an RFP and various others doing RFP's and then trying to coordinate after the fact, we did a single RFP. It also makes it easier for those submitting proposals to submit one to the group. We even went one step further and transferred all of the funding to a single point, in this case PSW, i.e. one set of forms, one administrator, and one coordinator. We had a panel review the proposals and then the different funders as a group, made the determination of what would be funded. This way they did not give up their fiduciary responsibility.

This process has worked well and we continue to use it, even as the funding sources have changed, the same evaluation group has come together to make the recommendations for what research should be funded.

These are just a few examples of how we have done things differently with success on the Oak Mortality Task Force with a great deal of success.





These elements are the basic framework for any diverse group is you are going to have a productive and successful group know matter what the issue is. I have been involved in many groups with very diverse and contentious if not polarized members. If you use these basic principles you can be successful. One of the most important elements is that those that are helping to lead this have to want to make it work and believe that it will. It is not and easy task and it will take coaching and lots of behind the scenes work at least in the initial stages. The last one of the group making the decisions is really important so everyone feels like they can own the decision. It will seem slow but it is a critical element and long term effectiveness of the group.

The people that will help organize and leaf this group are critical elements for success. Having the right people is key having the right groups and organizations from the beginning is extremely important. In most cases everyone is already fully employed if not overcommitted. If possible have someone act as or hire someone to help coordinate the group. Someone to take notes, organizing meetings, set up calls, etc. These things don't "just happen." Communications with the group is very important to build trust and just for information sharing, either through email or if possible through a web site. Most importantly, as I said before, be leaders and be patient.

I would like to challenge each of you as you go through the rest of the week and talk about the problems and overwhelming tasks to be preferred and the myriad of road blocks and agencies that you will have to deal with, to think about of doing things differently. It takes hard work and determination and some discomfort to change "the way you have always done it." If the "way we have always done it" has not been all that effective in achieving long term solutions, then the results of your efforts to change to a new way of getting things done will be worth any initial discomfort.

Each of you can play a role in doing things differently, either as a leader of the group, or supporting the efforts in finding the common ground, and applying your agencies or groups or your personal resources and talents to the issue, in order to come up with positive, coordinated solutions.

Plenary Session I
WFIWC

WFIWC Founders' Award Presentation:

A Tribute to Dr. Donald Lee Dahlsten (1933-2003), 2003 Founders' Award Recipient

The Western Forest Insect Work Conference Founders' Award was established in 1991 to honor individuals who have made outstanding contributions to forest entomology in western North America. The award recognizes significant contributions in pest management, extension, research, and teaching. First presented in 1991, to Mark McGregor, the award is given to but one qualified nominee per year; however, an award is not necessarily presented every year. Nominations are submitted by Conference members to the Founders' Award Committee, and nominations are voted on by members of the Committee. Since 1991, there have been 12 recipients. Professor Donald L. Dahlsten (UC-Berkeley) was our 11th awardee.

Typically, the award recipient addresses the Conference the year following receipt of the award. Don received the award at the 2003 Conference, posthumously—although he had been apprised of his selection just prior to his untimely and unfortunate passing. It therefore became necessary to depart from tradition somewhat; and a few of Don's colleagues chose the following method of paying tribute to him, in lieu of an acceptance address.

Founders' award ceremony participants (L to R): Leo Caltagirone, Tom Eager, Pat Shea, Carol Wright, Janet Dahlsten

Ken Gibson begins the ceremony

Ken Gibson presents award

Mrs. Janet Dahlsten accepts Founders' Award

Patrick Shea

Leonard Brennan

A Panel Tribute to Don Dahlsten
Patrick Shea and Tom Eager, Co-Moderators

Dr. Donald Lee Dahlsten was the 2003 recipient of the Western Forest Insect Work Conference's Founders Award. A tribute to Don started with Tom Eager reviewing Don's career as outlined in the Founder's Award nominating document. Tom had submitted Don's nomination for the award to the Committee.

Invited speakers were Dr. Leonard A. Brennan, Professor and Endowed Chair of Quail Research, Texas A&M University at Kingsville, TX and Professor Emeritus Leopoldo Caltagirone, Department of Entomology, University of California, Berkeley, who both reminisced about their personal interactions with Don.

Dr. Brennan took the opportunity to describe the importance and singularity of Don's career-long research on the role of insectivorous birds in western forest ecosystems. He characterized Don's 40 years of work using bird boxes to study food habits, foraging behavior and fledgling success of the mountain chickadee in the Sierra Nevada as unprecedented and without peer.

Dr. Caltagirone chose to reminisce about his personal interactions with Don and emphasized Don's kindness and dedication to his students. Dr. Caltagirone related how Don took the time to explain the intricacies of the National Football League and the importance of cheering for the 49'ers.

Pat Shea concluded the session by reviewing his relationship with Don on a professional and personal basis and then ended by reading a tribute prepared by Pat and Tom Eager that was entered in the notes from the Guadalajara WFIWC meeting and is presented on the first page of this Proceedings.

Research on Insectivorous Birds: A Few of Don Dahlsten's Contributions

Leonard A. Brennan
Caesar Kleberg Wildlife Research Institute
Texas A&M University-Kingsville

Don Dahlsten was an entomologist with ornithological credibility. His credibility in the world of ornithology was based on more than three decades of field research, and a series of resulting publications, which examined relationships between forest insect populations and insectivorous birds. Don's contributions to insectivorous bird research culminated with invitations from his ornithological colleagues to be a co-author of the mountain chickadee, *Poecile gambeli*, and senior author of the chestnut-backed chickadee, *Poecile rufescens*, species accounts for the acclaimed *Birds of North America* series (McCallum et al., 1999; Dahlsten et al., 2002; Figure 1). That the ornithological community invited Don to write these species accounts is clear evidence he was held in high esteem by this group of scientists. In today's world of hyper-specialization in science, it is a truly remarkable accomplishment for someone to be recognized as a leading expert on a topic outside of his or her primary area of investigation.

The purpose of this brief essay is to outline some highlights of Don Dahlsten's research on insectivorous birds. Although many of Don's entomological colleagues knew that he had long-term, ongoing projects on parids (chickadees and titmice), few understood or appreciated the stature that he gained among ornithologists over the years. This paper provides an opportunity to put this aspect of Don's career in a perspective that can be appreciated by his fellow forest entomologists. I will focus on these highlights of his work on chickadees as predators of forest insects.

Chestnut-backed and Mountain Chickadees

Don's projects on the chestnut-backed chickadee were initiated in 1973 in the Sierra Nevada and expanded in 1979 to the San Francisco Bay Area. Don initiated his work on the mountain chickadee in 1966 at a study area on the Modoc National Forest in northeastern California. Over the years this project expanded to include study sites in the Sierra Nevada and Tehachipi mountains. A common thread among these diverse study areas was a focus on diets of nestlings by using Super-8 movie cameras to record prey delivered by adults. As a by-product of these activities, which centered on grids of nest boxes, Don accumulated a tremendous amount of data on the breeding biology of these two species of chickadees.

Don's data on chickadee nestling diets were published in top-notch journals (see, for example, Grundel and Dahlsten 1991; Table 1; Kleintjes and Dahlsten 1992; Table 2) His data on breeding biology of chestnut-backed and mountain chickadees provided the foundation of these topics in the *Birds of North America* accounts (McCallum et al., 1999; Dahlsten et al., 2002).

Blodgett Forest Research Station

My initial interactions with Don took place from 1986 through 1989 at Blodgett Forest in El Dorado County, California as part of the field research for my dissertation project at the University of California, Berkeley. At Blodgett, both chestnut-backed and mountain chickadees were present, which provided opportunity to study these species in a zone of sympatry. This was an especially interesting topic because the chestnut-backed chickadee had expanded its geographic range during the past 40 years, and now overlapped extensively with the mountain chickadee.

During this time, we used the nest box grids as focal points for the study of differences in vegetation structure around nest boxes occupied by these two chickadees at Blodgett. During the breeding season, we also used nest boxes as foci for collecting extensive data on the foraging dynamics of these species, and continued collection of these data through the nonbreeding season by walking transects. Ultimately, a continuous set of foraging data spanning 34 months with >1,300 focal animal observations were collected (Brennan et al., 2000).

The outcome of these studies was that chestnut-backed and mountain chickadees exhibited broad overlap in their use of nest box sites (Figure 2; Brennan et al., 1999). The two species differed greatly in their use of some tree species, and overlapped broadly in their use of others (Brennan et al., 2000). For example, the foraging data showed that the chestnut-backed chickadee used Douglas-fir, *Pseudotsuga menziesii*, and California black oak, *Quercus kelloggii*, significantly more than the mountain chickadee. In contrast, the mountain chickadee spent significantly more time foraging on ponderosa pine, *Pinus ponderosa*, and sugar pine, *P. lambertiana*, than the chestnut-backed chickadee.

During the three breeding seasons of this study, both species of chickadees shifted their foraging to include a major increase in use of white fir, *Abies concolor* (Figure 3), presumably in relation to extraordinarily abundant bud-mining sawfly larvae. During the winter months, both species of chickadees shifted their foraging to include a major increase in use of incense cedar, *Calocedrus decurrens* (Figure 4), presumably in relation to an increase in population density of incense cedar scale. In most areas of their geographic ranges during winter, chickadees are extraordinary hoarders of seed foods in caches. We never observed chickadees hoarding food at Blodgett, presumably because the incense cedar scale provided and abundant and reliable food source through the winter.

The Tip of an Iceberg

This essay is just the tip of the iceberg with respect to Don Dahlsten's contributions to the ecology of insectivorous birds. A complete coverage of Don's research on insectivorous birds could fill an extensive book chapter or major review article in a scientific journal. In addition to the few citations noted here, Don published many other articles and book chapters based on data from his insectivorous bird research. Nevertheless, the common theme throughout Don's work in this field was that these were foundational studies grounded in a deep understanding of natural history. This is intellectually significant because Don's research on insectivorous birds was designed to lay the groundwork for future studies to ultimately tackle a grand question that has evaded ornithologists and entomologists for decades: Can avian predation on forest insects act as a mechanism to control pest outbreaks?

While it may be decades before this deceptively simple question is answered, Don's research identified critical links from tree substrates to arthropods to birds and how they prey on these food resources in space and time. The foraging data from Blodgett set the stage for future workers to tackle projects that will have a high probability of success for understanding the functional and numerical responses of birds to white fir sawfly larvae and incense cedar scale.

Finally, one of Don Dahlsten's most enduring legacies for insectivorous birds may be from data not yet published. Don's chickadee and titmouse banding data are among the longest strings of such data ever collected. These data range from 22 to 35 years, depending on the study area. Analysis of these data with contemporary mark-recapture techniques has the potential to be a major contribution to ornithological and wildlife science.

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TABLE 1. MOUNTAIN CHICKADEE NESTLING DIET
(N = 55,694, MODOC CO., CALIFORNIA, GRUNDEL AND DAHLSTEN, 1991)

Hymenoptera larvae	**38.6%**
Lepidoptera larvae	**25.0%**
Coleoptera adults	**12.6%**
Diptera adults and larvae	**8.2%**
Spiders	**5.6%**
Homoptera adults	**3.2%**

TABLE 2. CHESTNUT-BACKED CHICKADEE NESTLING DIET
(CONTRA COSTA CO., CALIFORNIA, KLEINTJES AND DAHLSTEN, 1994)

Monterey pine sawfly larvae	**42.6%**
Tree camel crickets	**17.0%**
Hemiptera	**4.9%**
Lepidoptera adults and larvae	**7.2%**
Spiders	**4.3%**
Homoptera	**7.3%**

Poecile gambeli

Mountain Chickadee

The Mountain Chickadee, a small, cavity-nesting songbird, is one of the most common birds of montane coniferous forests from southern Arizona and Baja California north to British Columbia and the Yukon Territory. The closest living relative of the more familiar Black-capped Chickadee (*Poecile atricapillus*), the Mountain Chickadee appears quite similar in biology to that better-studied species. Where the ranges of the 2 species overlap in the Rocky Mountains, they tend to segregate by habitat, but where both are sparse, most notably in the Rio Grande valley of New Mexico, they may hybridize extensively.

Mountain Chickadees cache conifer seeds as soon as they become available in autumn. The need to defend dispersed seeds promotes group territoriality and hierarchical social organization in this and other chickadees. Dominance hierarchies regulate social organization within groups, and many juveniles descend to the lowlands in seed-poor years. Migrants return to the same social groups of unrelated birds in the spring, and all members tend to mate within these social groups year after year.

Mountain Chickadees are monogamous and territorial for the breeding season. Parents show significant individuality in prey selection when feeding young. Mountain Chickadees abandon foraging in a location when the time to capture prey there significantly exceeds the time to capture prey in previous visits to that site.

The Birds of North America
Life Histories for the 21st Century

Figure 1.

Poecile rufescens

Chestnut-backed Chickadee

Found in humid coastal and interior forests from southeastern Alaska to southern California, this chickadee has expanded its geographic range during the past 5 decades by colonizing forest habitats in the central Sierra Nevada and suburban areas in eastern San Francisco Bay. Although plausible explanations have been proposed, the exact reasons for this geographic expansion remain unknown.

The Chestnut-backed Chickadee is apparently most closely related to other "brown-headed chickadees" such as the Boreal Chickadee (*Poecile hudsonicus*) and possibly the Grey-headed Chickadee (*P. cinctus*). Like its closest relatives (Mexican [*P. sclateri*] and Boreal Chickadees), this species lacks a whistled song; unlike them, it uses the Gargle call rarely. This reduction of repertoire diversity may be somewhat balanced by a particularly robust *Chick-a-dee* call complex.

Chestnut-backed Chickadees exhibit interesting patterns of foraging behavior by focusing on insects that live on Douglas fir (*Pseudotsuga menziesii*), and other conifer trees in the humid coastal regions and portions of the interior forest of the Pacific Northwest. They also make considerable use of insects and arthropod foods from broad-leaved trees. Like most chickadees and titmice, Chestnut-backed Chickadees nest in tree cavities and readily

The Birds of North America
Life Histories for the 21st Century

Figure 1.

Figure 1. *The Birds of North America* species accounts co-authored by Donald L. Dahlsten.

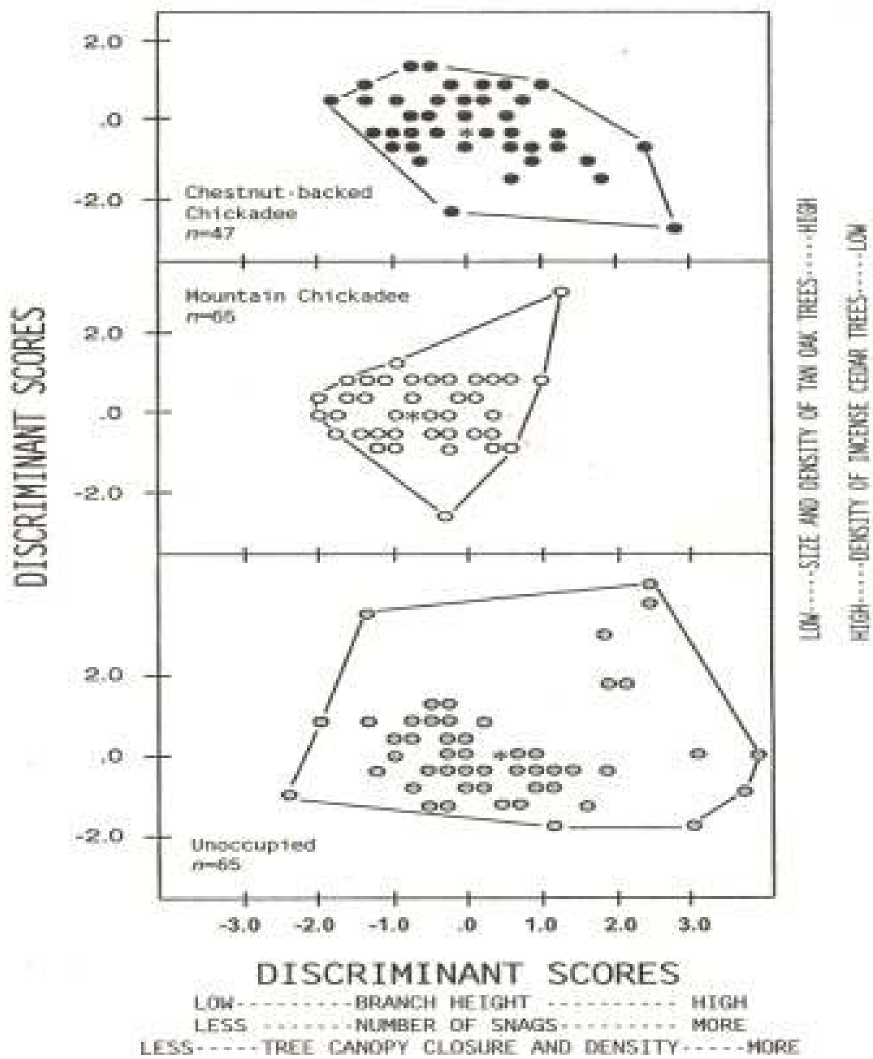


Figure 2. Overlap in habitat structure around nest boxes occupied by chestnut-backed and mountain chickadees at Blodgett Research Forest, El Dorado County, California (Brennan et al., 1999).

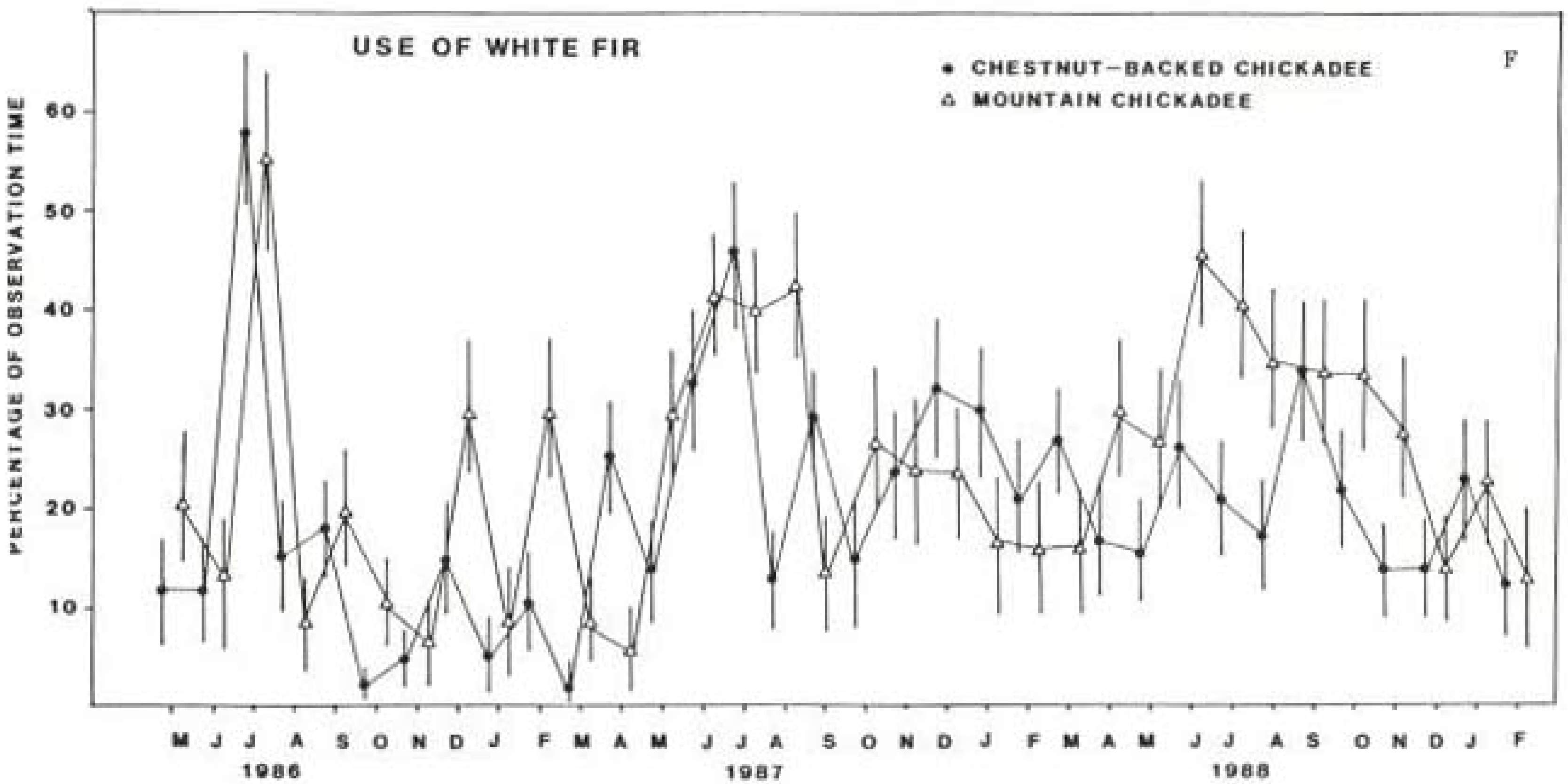


Figure 3. Use of white fir trees for foraging by chestnut-backed and mountain chickadees at Blodgett Research Forest, El Dorado County, California (Brennan et al., 2000).

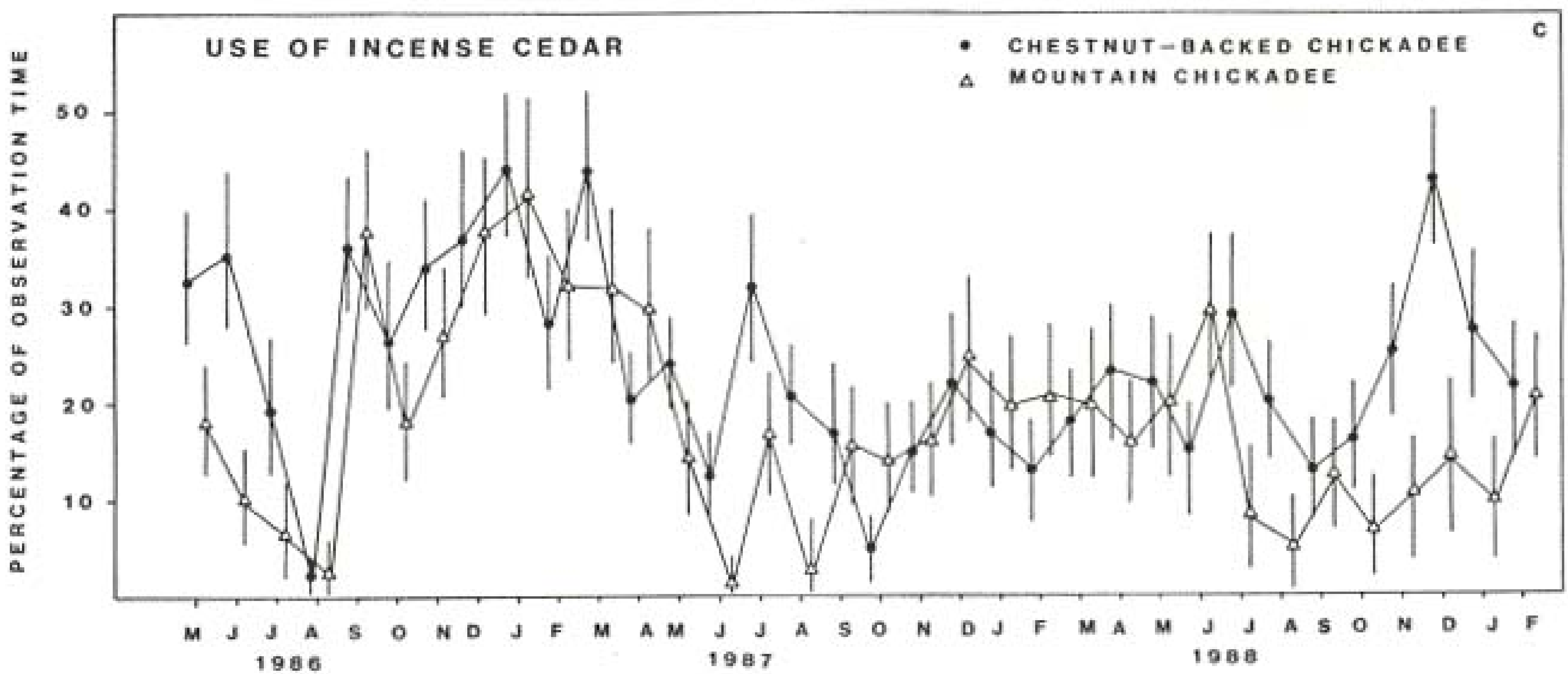


Figure 4. Use of incense cedar trees for foraging by chestnut-backed and mountain chickadees at Blodgett Research Forest, El Dorado County, California (Brennan et al., 2000).

Remembering Don

Leopoldo Caltagirone
Emeritus Professor of Entomology/Biological Control
ESPM – Insect Biology, University of California, Berkeley

I am honored to address you on the occasion of the WFIWC Founder's Award presentation as a tribute to one of its distinguished members – the late Don Dahlsten. Thanks to Pat Shea and the other organizers of this event for inviting me to be here.

Don's valuable scientific, educational, administrative, environmental accomplishments are well known to you, so I will not repeat them. Instead I would like to reminisce a little on the friendship that developed over many years between Don and me.

When Don joined the UC Berkeley Division of Biological Control at the Gill Tract I was already a member of that group. Because my activities were in agriculture and Don's were in forestry our interactions were limited to the general conversations in which all researchers, technicians, students, and visitors participated during the daily coffee breaks. Eventually I began to like this guy who had very clear professional goals, was very committed to try solving some environmental problems, and had political ideas close to mine. I cannot describe the very gradual process that took us from being colleagues in a research and teaching unit to considering ourselves friends. This process was accelerated when we discovered that he and I liked good food and good wine.

I did not collaborate with him in research until he undertook his work on biological control of eucalyptus psyllids; but frequently we discussed, argued, and mulled over subjects such as the definition of biological control, whether our research should be basic or applied, whether there was too much politics in academia, whether undergraduates were getting a fair treatment at Berkeley. However our conversations were much more varied; they included sports (the little I know of football and baseball I owe it to him), music (especially opera), wine (big subject!), food, traveling experiences, and in the later years our aches and pains

Our profession gave us opportunities to travel: to Spain and France in search of natural enemies of elm leaf beetle and deciduous fruits and nuts microlepidoptera (we also admired the vineyards of La Rioja and the Rhone Valley and enjoyed their products), to Chile to teach a course in biological control with Ken Hagen, Robert van den Bosch, Dick Garcia and others from the Berkeley and Riverside campuses; to Brazil to attend the VII Symposium in Biological Control, to Mexico where we collaborated with our local counterparts in the biological control of the red-gum lerp psyllid.

Don was passionately committed to his science, a devoted teacher, always concerned with the welfare of his students; an effective administrator (he claimed he didn't like administrative work, but I never believed him). He was most loyal to the University of California, although he would let you know in no uncertain terms when he did not agree with university policies, which was not infrequent. This applied also to individuals: although he felt in disagreement, sometimes intensely so, I never heard him make maliciously a derogatory remark against anybody.

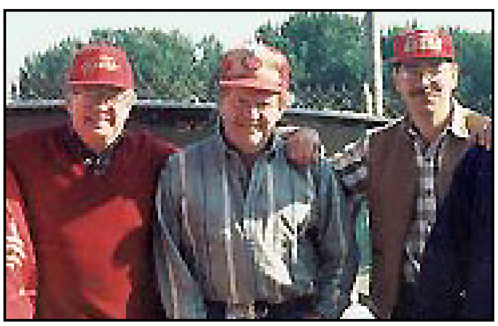
Don and his wife, Janet, were most gracious and generous hosts to their many visitors: researchers, prospective students, and just friends. My wife and I were frequent participants of the Dahlstens' hospitality.

For me, an immigrant with no other relatives near me, except my immediate family, Don's close friendship had an enormous value. I am greatly indebted to him. I miss him very much.

Don's Research Philosophy

- Work, Study, Get Ahead
- Drink, Party, Fool Around

…and the wisdom to know the difference!



Dave Wood, Don Dahlsten, and Steve Seybold
at a San Francisco 49er tailgate party (ca. 1994)

WFIWC Memorial Scholarship Address

Brian Aukema, University of Wisconsin – Madison

Impacts of Predators on Population Dynamics and Behavior of a Bark Beetle Prey: Implications for Biological Control

Brian Aukema

Darrell Ross, Chair WFIWC Scholarship Committee, awards Brian Aukema the 2003 WFIWC Memorial Scholarship

As I told David Wood last night, it is quite intimidating to follow a memorial to the life and work of Don Dahlsten. As I survey the room, I see a number of pioneers who have contributed in many ways to the science of forest entomology and the rich history that WFIWC enjoys. I would like to express my sincere appreciation to WFIWC for the memorial scholarship, which allows me to attend this meaning and learn from many of you. Thank you.

I studied for the Master's degree in entomology from 1997-1999 in the laboratory of Kenneth Raffa at the University of Wisconsin-Madison, where I worked on a collaborative project with Don Dahlsten at the University of California-Berkeley. We examined how behavioural disparities between bark beetle pests and their predators to bark beetle pheromones could potentially be applied to pest management operations such as pest monitoring, trap-out, or predator augmentation.

We used the pine engraver bark beetle, *Ips pini*, as our model system. *Ips pini* is found across the US and Canada, breeding primarily in stressed pines. It can be a major problem in timber harvest operations, or in plantation forests such as the red, jack, and white plantations in the Great Lakes Region. The male is the host selecting sex. It bores into trees and emits frass and aggregation pheromones that attract large numbers of male and female beetles to the trees. Males construct nuptial chambers beneath the bark, and are joined by typically two or three females. The females construct ovipositional galleries leading away from the nuptial chambers, and lay eggs in niches along the galleries. The niches are then packed with frass. When the eggs hatch, the larvae mine laterally throughout the phloem away from the galleries, effectively girdling the tree. The tree dies of water stress.

The aggregation pheromone of *I. pini* consists of ipsdienol, produced in two different enantiomers, and, in some locations, lanierone. The ratio of the two stereoisomers of ipsdienol varies, depending on geographical location.

During my Master's work, we found that deploying different combinations of the stereoisomers of ipsdienol and lanierone at different times of year captured different combinations of pests and predators. For example, deploying lures with high (+) amounts of ipsdienol, or racemic mixtures, with lanierone, attracted approximately 25 times more pests, ie. *I. pini,* than predators, ie., clerids and histerids, to the traps. Conversely, deploying lures with a high (-) ipsdienol content, with or without lanierone, attracted approximately 10 times more predators than pests.

I stayed at the University of Wisconsin with Ken Raffa for my Ph.D. in Entomology, and a concurrent MS degree in Biometry, from 1999-2003. For this presentation, I will only focus on my doctoral work in Entomology. I was intrigued by the behavioural disparities shown by select predators to the pheromones of *I. pini*, and wanted to augment these studies with broader studies on the community ecology and impacts of these predators on *I. pini*. I would like to focus on four questions today.

What is the community assemblage in trees colonized by *Ips pini*?

To determine the community assemblage of *I. pini*, we colonized red, jack, and white pine logs with male *I. pini* and transported them to red pine plantations. We sampled arriving insects with sticky screens. After three weeks, when insects were almost ready to emerge, we retrieved the logs. We placed the logs in rearing tubes in the laboratory, and collected all emerging insects three times per week. This experiment was replicated multiple times over two years.

Sticky trap catches sampled more than 80 species of insects from three orders. There was very strong temporal and host species partitioning among the natural enemies. However, we found no difference in *I. pini* reproduction among host trees.

I found seven major community associates of *I. pini*. *Zabrachia polita*, a Dipteran predator, is found primarily in red pine hosts, while *Roptrocerus xylophagorum*, a Hymenopteran parasitoid, is found primarily in white pine. *Monochamus* spp. (Coleoptera: Cerambycidae), competitors or facultative predators, are also found primarily in white pine. We also sampled or reared high numbers of *Medetera bistriata* and *Lonchaea corticis*, both Dipteran predators found in all three pine hosts. I would like to focus primarily on *Platysoma cylindrica*, a histerid beetle, and *Thanasimus dubius*, a clerid beetle, for my presentation today.

Platysoma cylindrica is approximately the size of an adult *I. pini*. These beetles enter the pine engraver galleries and use the gallery architecture to confine their prey at the terminal ends. The *I. pini* are seized, crushed, and consumed. *Platysoma cylindrica* adults lay eggs within the bark beetles galleries, and the developing histerid larvae wander throughout the phloem preying on developing bark beetle progeny.

Thanasimus dubius adults prey on bark beetles landing on the surface of the tree. Their progeny develop within the bark beetle galleries, also preying on developing bark beetle brood.

Is there evidence for predator impacts on population dynamics in the field?

This is part of the broader question, "What factors drive bark beetle population dynamics?" There are a number of such factors, such as resource availability, weather patterns such as temperature or precipitation, and biotic factors such as competition and predation. For my post-doctoral work, I am currently studying how competition may mediate mountain pine beetle population phase transitions between endemic and outbreak populations with Allan Carroll at the Canadian Forest Service in Victoria, British Columbia. Here, I would like to present evidence of both delayed and direct density-dependence exhibited by predators with respect to *I. pini* populations.

First, my colleague Nadir Erbiligin has demonstrated delayed density dependence within years. The number of late season *I. pini* is inversely correlated with *T. dubius* populations in early and mid season of the same year. Delayed density dependence can also be detected across years. *Ips pini* during early 1999 was inversely related to the number of *T. dubius* from 1998. These results held over a three year study, and are true for both *T. dubius* and *P. cylindrica*.

I incorporated a number of weather variables into models of weekly trap catches in red pine plantations to model flight activity of *I. pini*. I then examined evidence of direct density dependence by examining whether these models could be improved by adding terms for predator counts. The trap catch per week increased with mean high daily temperature, and increased with the number of days of rain with more than one half of an inch of rain. This was possibly due to a holdover effect, as beetles stop flying during a rain. The total trap catch did decrease with total precipitation. When the number of *T. dubius* captured simultaneously in the traps was added to the models, the model fits improved. *T. dubius* reduced the trap catch on a weekly basis. This was also true of *P. cylindrica*.

Can we quantify predator impacts?

I would like to examine two questions. First, what are the relative and interacting effects of predation vs. competition for this bark beetle, and second, how do the two predominant predators *T. dubius* and *P. cylindrica* interact? For these questions, I used laboratory experiments in which a standardized section of log was colonized by insects, the insects were reared, and then the bark was peeled to determine colonization success and life history variables. All initial experimental densities were based on field observations and values found in published literature.

Predation and intraspecific competition both decrease the total number of *I. pini* progeny per female. Using coefficient comparisons, we can calculate that the mortality imposed by one arriving adult *T. dubius* to the tree is the same as that imposed by four competing male *I. pini* and their recruited females.

I also examined how multiple predators interact. This question is important for biological control, especially when working with generalist predators. Although *T. dubius* and *P. cylindrica* are habitat specialists in that they orient to trees undergoing colonization by bark beetles, they are feeding generalists once at the tree or under the bark. Multiple predators may have synergistic effects of prey capture, for example, if one predator chases the prey to the other. Conversely, one predator species may eat the other and the prey may proliferate.

In this experiment, I varied the densities of each predator in a density matrix, using a constant density of *I. pini*. Each predator decreased the number of *I. pini*, both on a total and per parent basis. Their effects were additive, symmetric, and linear. These two predators proved to be substitutable. The number of their progeny plateau or even decrease at high predator densities. I attribute the lack of emergent multiple predator effects in this system to two things. First, these predators are separated in time. *Ips pini* emerge at approximately 35 days, while *P. cylindrica* and *T. dubius* emerge a few weeks later. Almost half of the *P. cylindrica* emerged from the logs prior to emergence of *T. dubius*, and this temporal separation partially precludes using them as a food source. Second, these predators are somewhat separated in space. *Thanasimus dubius* adults are exophytic predators, while *P. cylindrica* adults are largely confined to ovipositional galleries. The larvae, while wandering through the phloem, may be afforded some protection from predation by the parents.

Do predators influence behavior?

I would like to examine three questions under this topic. First, can predation reinforce aggregation behaviour in bark beetles? Second, is predation a possible cost to cheating? And third, can we incorporate these impact data into models of semiochemical evolution?

To examine the effects of predators on the fitness consequences of aggregations of bark beetles, we added two *T. dubius*, two *P. cylindrica*, and two of each predator to rearing cans containing different densities of bark beetles, from 0.5 to 2.0 males/dm^2. Two females were added for each male. The total number of bark beetle progeny began to plateau at higher densities due to the effects of intraspecific competition. Predators reduced these numbers in additive manners. At low densities, approximately 1 in 4 or 5 bark beetles were eaten, but this decreased to 1 in 10 beetles eaten at average field densities and higher. If the effects due to competition were factored out, predators again had additive effects on the net replacement rate of *I. pini*. I constructed a generalized colonization map for this experiment, and we can see that as density increases, the number of colonizers decreases and the number of bark beetles excluded from the logs increases. The number eaten decreases with increasing density of arriving cohort.

Cheating, as defined by Birgersson in 1988, is defined as responding to pheromones but not engaging in host searching. He proposed this could be a behavioural strategy that changes under different conditions. For example, a cheating strategy could be favoured when host resistance and conspecific populations are high, or the bark beetle has a long life span. The effect of predation on cheating has not been evaluated. We examined the effect of predators on pioneering vs. responding male *I. pini*, and male vs. female *I. pini*, in a laboratory assay using *T. dubius* and pine engravers in red pine bark arenas. We found that late-arriving males, or "cheaters," suffered higher predation than pioneering males, while there was no effect of the presence or absence of cheating males on the survival of arriving females. The male to female ratio increased with increasing predation pressure when cheating males were accounted for, as late arriving males were likely eaten while constructing nuptial chambers. This raises the possibility that predators mediate the male:female ratio on the host tree.

Finally, these results have shown that *T. dubius* and *P. cylindrica* exert equal and opposing forces on *I. pini*. Until now, a proposed predator prey coevolution model has been supported by behavioural disparities to *I. pini* pheromones, where *T. dubius* prefer more (+) blends, *P. cylindrica* prefer more (-) blends, and the pine engravers prefer a racemic or slightly more (+) blend. It is hoped that these impact data further inform this model.

Conclusion

In conclusion, *I. pini* has a diverse assemblage of associates, but this assemblage is dominated by a few species. Populations show evidence of density dependence, both direct and delayed, in the field. Predators exert mortality beyond the losses strictly due to competition. On a broader scale, it is possible that predator behavior evolved in response to the social system of bark beetles, but now reinforces it. This is a strong possibility in species that attack poorly defended trees. Predators find prey by kairomones, but there is not perfect synchrony. This finding, in concert with impact data, suggests predator-prey coevolution. These results also reiterate some of Don Dahlsten's work in biological control. That is, it is important that we conserve multiple species in this system, as these predators, although substitutable, demonstrate primarily additive interactions.

I would like to thank a number of people who have helped with these projects. This includes my PhD advisor Professor Kenneth Raffa; my PhD committee, my Biometry advisor Murray Clayton, the many student workers who helped on these projects, my fellow lab members, funding sources, and my wife, Kelly.

Plenary Session I

WIFDWC

2004 Achievement Award Address
Everett Hansen
Oregon State University

Persistence and Spread of *Phytophthora ramorum* in Oregon

Last year in Grants Pass, when Rona announced my name, I was speechless. Even today, I am embarrassed to admit how pleased I am to have this recognition from my colleagues. Thank you.

Sudden oak death has triggered some unpleasant reactions in the forest pathology community. Those few of us lucky enough to have the disease from the beginning in our own pathological neighborhoods have generally been greeted with skepticism, and some scorn even. I haven't taken it personally; I know you are all just jealous. But now, thanks to Monrovia, the gravy train will be stopping at a nursery near each of you. Welcome aboard. I offer a short message of progress and hope. I want to review some of our experience and results from the Oregon eradication effort. I am encouraged as we approach our fourth year; we feel that we are making headway in the eradication program, and we certainly are understanding the disease better.

Phytophthora ramorum is confined within an 11.5 square mile quarantine zone in Curry County, Oregon. Even this small infested area is misleading. As of this meeting, we know of exactly 1 infected tanoak tree in Oregon. All the rest have been cut and burned. This is not to say that *P. ramorum* is gone from the treatment areas. It persists on some sites three years after burning. As part of our monitoring effort, we established 43 tanoak stump plots on five of our eradication spots that were cut and burned in 2001. We continue to track the pathogen in soil and on sprouting host plants and planted trees around each of these stumps.

In repeated sampling in 2003, we recovered the pathogen by baiting from soil collected within 1 meter of 6 of the 43 stumps. This contrasts with nearly 100% recovery from soil in California infested areas. We planted redwood and Douglas-fir seedlings around 33 of the stumps. None have been infected. Wild rhododendron and evergreen huckleberry were present on these sites, and have sprouted back after the treatments. Rhododendron sprouts are present around 18 stumps; none have been infected. Huckleberry has sprouted back around 28 stumps; in 3 plots it was infected. By contrast, 41 of the 43 tanoak stumps sprouted, and sprouts around 38 of these were infected by *P. ramorum*. Some sprout infections evidently originated by canker extension from the stump itself. In other cases, however, lesions on sprouts did not extend from the stump, but apparently originated from aerial or splashed inoculum.

To test the persistence of *P. ramorum* more directly, we inoculated leaves of tanoak and rhododendron and placed them back on eradication sites in mesh bags. After 8 weeks, the pathogen was recovered from > 80% of leaves that were shaded or buried, but from only about 20% of leaves exposed to the sun on the soil surface.

We have found that the pathogen is readily recovered from streams by baiting with leaves. Recovery remains high from streams draining eradication sites, 3 years after treatment. The source of inoculum is not clear.

Myrtlewood, or California bay, is seldom found infected in Oregon, perhaps because we have prevented a buildup of inoculum to levels necessary to initiate infection of this relatively resistant tree. In California, bay is thought to be an important source of inoculum, driving the epidemic, especially in coast live oak forests. It doesn't play this role in Oregon, so what is the source of inoculum for new infections? We felled and dissected 27 living tanoak trees adjacent to trees killed by *P. ramorum* the previous year. Fifteen of these had bleeding bole cankers; *P. ramorum* was isolated from twigs high in the crown of 11. Twelve trees had no bole infections, and the pathogen was isolated from twigs of only 3 of these. It appears that initial infection occurs in the upper crown of tanoak trees, with bole infections resulting from spores washed and splashed downward. This is supported by the finding that understory rhododendron and huckleberry are found infected only when growing immediately beneath the crown of an infected tree.

We have also begun to analyze the movement of *P. ramorum* across the landscape. Infected trees are clustered at several scales. The entire Oregon infestation occurs in just two north-south drainages, separated by a low divide. Clusters of infected trees are concentrated at the south end of the area and taper off to the north. We measured the distance from every infected tree newly discovered in 2003 to the nearest infected tree discovered in a previous year. We plotted tree frequency against distance, and have begun to study the resulting dispersal gradient. Half of the trees are found within 100 feet of a previously infected tree, but there is a very long tail to the curve. The pattern is indicative of contagious spread in turbulent air from discrete inoculum sources. There is no indication of background, or preexisting, inoculum. The long tail to the distribution is disturbing.

We feel that we understand better the dynamics of disease spread in Oregon forests. Can we use this information to improve our eradication success? Certainly we see no encouragement in weather records. The Brookings area is known for its very mild winters, with much more rain, more months of the year, than Marin or Sonoma Counties in the main California epidemic area.

Tanoak stump sprouts are an obvious target for our eradication crews. We were unable to treat them in the first year, for logistical reasons. Now, however, all sprouts on our treated areas have been killed with herbicides, and all newly created tanoak stumps are treated at cutting to prevent sprouting. The disease dispersal gradient suggests that our treatment buffers are not large enough. Cutting more trees surrounding infected trees is often possible on industry land, but is a harder sell in the urban interface at the south end of our regulated area. We are also wondering about no longer removing the myrtlewood from our treatment sites. In our conditions these trees do not seem to be infected, and leaving them would increase property owner acceptance of the program in some cases.

Our biggest challenge is finding infected trees in the long tail to the disease distribution to the north of the main infested area. Aerial detection and ground checking work for killed trees, but we can't find the early infections from the air. To focus our surveys, we are expanding our system of stream monitoring, adding 50 baiting stations arrayed in the path of expected spread.

We are encouraged by the observed lack of lateral spread in the ericaceous understory around our infested sites. Wild rhododendron, *Vaccinium* species, and other susceptible shrubs form a dense forest understory throughout the Oregon Coast Ranges and north to British Columbia. Climatic conditions appear to favor the pathogen the length of the Pacific Coast. Perhaps the epidemiological risk is not so high as we have feared. Spread through the nursery trade remains the wildcard. This year's excitement with the sale of infected camellias throughout the country from southern California nurseries highlighted the distribution possibilities. Now we hold our breath.

I thank my colleagues at the Oregon Departments of Forestry and Agriculture, the Forest Service, and Oregon State University for the team effort that supports the SOD control and research program. Financial support of my program comes from the Forest Service Regions 5 and 6 and the PSW Experiment Station, as well as the Oregon Department of Forestry.

Sheri Smith and Andy Eglitis

Sheri Smith and Terry Rogers

Sheri Smith addresses plenary session

Plenary Session II
Interactions of Air Pollution with Forest Health
Co-moderators: Michele Eatough-Jones and Timothy D. Paine

Introduction: Timothy Paine, Department of Entomology, University of California Riverside

Although air pollution affects many ecosystem types worldwide, forests in particular may be vulnerable to air pollution effects. The interaction of plant height and canopy architecture with atmospheric deposition processes leads to higher inputs of atmospheric pollutants into forests compared to other ecosystems with lower vegetation cover. Ozone and nitrogen deposition are considered to be the two most important pollutants affecting forest ecosystems in North America. Estimates made in 1990 showed nearly 25% of forests worldwide and 60% of temperate forests were exposed to ≥60 ppb O_3. In many regions in the USA and Europe, average atmospheric deposition of nitrogen has increased from 2 to 5 kg/ha/yr to 10-20 kg/ha/yr, with areas near sources exceeding 50 kg/ha/yr.

Meeting in San Diego, we are near the best studied, and most seriously impacted forests world-wide. Air pollution effects in forested ecosystems are also present in other Pacific, Intermountain, and Rocky Mountain states, and are a growing concern globally, with many more groups researching these interactions. Air pollution as been linked as a factor exacerbating problems with many forest pests and pathogens.

Nitrogen Deposition to Western Forests: Sources And Impacts

Abby Sirulnik, Department of Botany and Plant Sciences. University of California Riverside

Western forests receive nitrogen (N) deposition up to 45 kg-N/ha/yr in some areas. Unlike the northeastern U.S., N deposition patterns in the west show local areas of high deposition and strong gradients surrounded by steep drop-offs in deposition loads. Eastern forests, in contrast, show large regionally affected areas with uniform distribution of deposition loads. Monitoring deposition levels in western forests requires the identification of deposition "hot-spots" and recognition of the unique environmental characteristics of each affected area. Also of great importance in monitoring N deposition to western forests is considering the effects of ozone pollution and interacting effects with N. The effects of nitrogen pollution to western forests concerns human and ecological health as well as the timber industry and deserves serious attention as a major environmental issue.

Physiological Basis of Ozone Injury

Nancy E. Grulke, Pacific Southwest Research Station, USDA Forest Service

Tropospheric ozone concentrations have already doubled and are expected to increase 20-50% in the next 20 years. If ozone concentrations are moderately high (> 70 ppb hourly average over the growing season), its effects should not be considered without concurrent nitrogen deposition effects. Ozone exposure reduces carbon gain in most plants, alters the way that plants maintain a favorable water status, and significantly alters within plant carbon and nutrient allocation. Plants significantly differ in their ability to tolerate ozone exposure. Variations in ozone uptake, initial nutritional status, plant age, endogenous metabolic rate, and the capacity of the foliar antioxidant system all affect plant sensitivity to ozone exposure. There are two methods generally used for assessing yellow pine (ponderosa and Jeffrey) response to oxidant exposure in California: the Ozone Injury Index (OII) and the Forest Pest Management (FPM) assessment. For both methods, chlorotic mottle and needle retention form the basis of the assessment. Chlorotic mottle (yellow splotches on foliage) increases with exposure to ozone. Nitrogen deposition mitigates the injury, drought stress exacerbates it. Both the number of leaf age classes (in evergreen species) and the number of leaves within an age class is reduced with increasing ozone exposure. Nitrogen deposition increases foliage turnover and further reduces foliar retention when combined with ozone exposure. In years of extreme drought, an improvement of the appearance of the foliage can occur if more symptomatic foliage has been excised. Root mass is significantly reduced with both high ozone exposure (> 80 ppb hourly average) and high nitrogen deposition (>40 kg/ha yr). Under such conditions, carbohydrate content of foliage and fine and medium roots is also reduced. Since the plant has fewer roots for overwinter carbohydrate storage, trees sensitive to ozone exposure store carbohydrates in their bole. Younger trees (pole-size) are more likely to respond in this way than old growth trees (250 yr old). The response of these two key attributes to cumulative O3 exposure, nitrogen deposition, and drought stress were described using field examples from both ponderosa and Jeffrey pine.

Tree Diseases and Mortality in California Forests Impacted by Ozone

John Pronos, USDA FS FHP, R5, Sonora, CA

Many forest stands in California are impacted year after year by high levels of ozone. The most affected are in the San Bernardino Mountains east of Los Angeles and the southern portions of the Sierra Nevada east of Fresno. Two questions often asked are: How does ozone interact with other tree diseases and does ozone kill trees directly? Four study networks summarized in the table below have been used in California to gather information on how ozone affects forests.

Name/Location	Agencies Involved	Year Begun	Purpose
Southern California – San Bernardino Mtns.	Pacific Southwest Res. Sta./ Environ. Protection Agency	1974	Research
Southern Sierra	Forest Health Protection	1977	Incidence and trend

Nevada – Sierra & Sequoia Nat. For.			information
Project FOREST – Entire Sierra Nevada	Forest Service – Region 5, PSW, National Park Serv.	1991	Research, trend information
National Ozone Biomonitoring Project – California-wide	Forest Health Protection/ Forest Inventory & Analysis	2000	Incidence and trend information

The major forest tree diseases that are present in areas with high ozone pollution include root diseases (annosus, Armillaria and black stain) and mistletoes (true and dwarf). Of these only annosus (*Heterobasidion annosum*) and black stain (*Leptographium wageneri*) root diseases have been studied for their interaction with ozone. For annosus it was found that the pathogen will colonize a greater proportion of stump surface and grow down into the stump faster in trees with severe ozone injury compared to trees with little or no injury. Ozone stressed ponderosa pine seedlings in the lab were more frequently infected and had more stain when inoculated with the black stain root disease pathogen. The conclusion in each case was that ozone stressed forests may be more susceptible to annosus and black stain root diseases.

The causes of tree mortality were determined in ozone injury trend plots in the southern Sierra Nevada for 23 years (1977-2000). During the study period, 19.6% of the plot trees died from all causes. Ozone was judged to be the primary cause of death in 36.5% of these tree deaths.

In summary, (1) the occurrence of ozone injury in California forests is well documented; (2) the changes over time in ozone injury to forest trees is being followed; and (3) the way ozone interacts with other tree diseases, and the role it plays in tree mortality has not been adequately studied.

Air Pollution and Insect Herbivore Communities

Michele Eatough-Jones, Department of Entomology. University of California Riverside

Air pollution is affecting an increasing number of forests worldwide. Nitrogen deposition and ozone are considered to be the two most important anthropogenic pollutants affecting forest ecosystems in North America. Ozone and nitrogen pollutants may alter patterns of plant growth and allocation, and affect nutritional quality of foliage, which may subsequently affect insect herbivore communities. I examined changes in the herbivore communities of three prominent plant species (ponderosa pine, California black oak and bracken fern) at six sites along an air pollution gradient. Three western sites were associated with high ozone and nitrogen input, while three eastern sites received lower atmospheric input. There were no consistent patterns associated with herbivore abundance, richness or diversity along the air pollution gradient for any of the three plant species examined. However, herbivore groups showed patterns of change that followed the air pollution gradient that were apparent through discriminant function analysis. For bracken fern and oak, chewing insects were more dominant at high pollution sites. These changes in herbivore communities may affect nutrient cycling in forest systems.

Since nitrogen emissions in southern California are expected to increase I also examined herbivore community response to further nitrogen additions at a high pollution site and a low pollution site. Oak herbivore communities at the high atmospheric deposition site were altered by further nitrogen fertilization. Fertilized plots had higher abundance of pollen feeding beetles. Changes in oak's allocation of resources to reproduction is a likely driving force behind the change in herbivore communities at the high pollution site. Pine herbivores communities showed a response to nitrogen fertilization when atmospheric deposition was low, but not when atmospheric deposition was high. Abundance of flea beetles decreased on these fertilized trees. Patterns of resource allocation in pine that affect herbivore population composition were not further altered by increased nitrogen at the high deposition site. Changes in the pine herbivore community at the low deposition site are likely tied to changes in resource allocation in pine with increased nitrogen availability. This research suggests that herbivore communities will all be effected as nitrogen deposition increases in southern California. Pine herbivore communities are expected to show a response at lower inputs of nitrogen, but stabilize as nitrogen input increases to high levels. Oak herbivore communities may be most affected at high levels of nitrogen inputs.

Plenary session audience

Plenary session audience

Plenary Session III: Conference Finale
Moderator: Everett Hansen

Climate Change and Vegetation Response

Dr. Ronald P. Neilson
(rneilson@fs.fed.us)
MAPSS Team Leader, USDA Forest Service
PNW Research Station, Corvallis, OR

The MAPSS Team has constructed simulation technology to forecast ecosystem and fire responses to climatic variations and change over both short (months) and long (decades to centuries) timescales. The model is being validated against historical records and is now producing the first national scale, high-resolution forecasts of vegetation change and fire risks in the U.S. that incorporate climate-driven year-to-year changes in fuel loadings and moisture characteristics.

The public is often confused by the multitude of possible future climates and the associated ecological responses. Rather than focus on a single scenario, which may seem less confusing but is inherently deceptive, we have chosen to examine as many scenarios as possible, ranging from small to large temperature increases, to see if there were any consistent patterns. The use of the MAPSS equilibrium biogeography model allowed the examination of 7 scenarios, but only as "snapshot" comparisons of current vs. future conditions, with no indication of how the biosphere might dynamically have evolved between the current conditions and the end of the 21st century. Consistent patterns have emerged from the comparison of the 7 scenarios. In some instances all 7 scenarios produced the same sign of change: for example, spatial shifts of cold-limited ecosystems and increased moisture throughout most of the West. In other instances, certain trends followed the increase in temperature across all 7 scenarios, where regional differences in precipitation produced the 'noise' around the regression line: for example, forest area might increase under mild warming, but decrease under greater warming. Similarly, the area of the U.S. subjected to drought stress appeared to increase linearly with respect to the projected temperature change. A 4.5 ^{o} C rise in temperature could drought-stress about 50% of U.S. forest area (while the other 50% shows increased growth), suggesting that near 4.5 ^{o} C could be a threshold below which U.S. ecosystems could sequester carbon, but above which they could lose carbon. Earlier, global simulations produced similar results. It may be that much of the world could become greener during the early phases of global warming, only to reverse in later stages, if the world warms toward the hotter end of the possible future temperature increases.

The MC1 results provided some sense of how the terrestrial biosphere could change along two temporal trajectories chosen among the 7 scenarios, one near the mild end of possible future temperature changes and one near the warmer end. The overall results from MC1 were quite consistent with those from MAPSS, even though there were some differences in details. As hypothesized from the MAPSS results, the moderately warm Hadley scenario produced increased vegetation growth and reduced drought stress throughout the 21st century. Also as anticipated, the warmer Canadian scenario, exceeding the 4.5 ^{o} C threshold, produced large areas of drought stress resulting in net carbon losses by the end of the century. However, the Canadian scenario deviated from the 'linear' logic of the MAPSS-based hypothesis of early greenup, followed by later browning. The hypothesis presumed that precipitation increased linearly with temperature, which did not happen in the Canadian scenario since drought stress began almost immediately. These results should not be taken too literally, since a different Canadian simulation with different initial conditions might produce a different trajectory. Fires increased significantly in the interior West due to increased fuel loads from increased precipitation. Massive fires also occurred in the eastern and southeastern U.S., but only under the warmer of the two scenarios. Drought and fire were the mechanisms responsible for converting much of the Southeast from forest to savanna and grassland under the hotter scenario. These results underscore the importance of inter-annual and inter-decadal climate variability, the potentially large impact of climate variations on ecosystems and the need for further use and development of dynamic vegetation models using various ensembles of climate change scenarios.

Finally, both transient scenarios included large changes in regional weather patterns. Each scenario, even the milder HADCM2SUL scenario, produced regional impacts of drought and fire that could cause significant distress to regional ecological and economic systems while warmer and wetter climates could benefit other regions. Given the uncertainty among future scenarios, managers would be well advised to develop contingency plans for alternative futures, increased vegetation growth, or increased vegetation stress, with specific regional patterns and timing to both. Monitoring could be configured to identify these alternative conditions as they occur. Among the largest uncertainties in these results is the importance of the CO_2-induced water-use-efficiency, which is incorporated in all results presented here. If the effect is less than that simulated, then the early greening would be less than presented here and may not occur in all ecosystems.

Increasingly frequent wildfire in ecosystems has been largely attributed to decades of fire suppression and fuel buildup, but recent climate variability likely also plays a role. At the same time, human population density in the wildland-urban interface (WUI) continues to increase at a substantial rate. We have developed technology to simulate dynamic ecosystem responses to climate variation and change over continental scales and including wildfire simulation. Simulations of the past 100 years and the next 100 years suggest that climate variability over the past few decades of the last 100 years has been unique and largely determines where and when fires occur. Future climate change could substantially increase the risks from wildfire, especially in the wildland-urban interface.

There are two major U.S. policy tracks with apparently opposite goals. On the one hand, the expanding wildland-urban interface has promoted policies aimed at reducing fuel, and thus the risk of catastrophic fires, and to improving forecasts of the risks and locations of future fires. On the other hand, efforts to limit increases in atmospheric CO_2 have made policies that promote enhanced carbon storage in ecosystems a major part of the U.S. Climate Change Program. Fuels in the West have increased to catastrophic levels due to fire suppression. In addition, recent research and observations suggest that fuels in the West have also increased due to ocean-climate 'regime shifts', such as those associated with changes in the Pacific Decadal Oscillation (PDO) in the mid-1940s and mid-1970s. Woody expansion in the West contributes considerably to carbon storage in U.S. ecosystems. The contradiction is that the preventative fires commonly used to reduce fuel increase CO_2 in the atmosphere and shrink the amount of carbon stored in ecosystems.

Both observed and simulated fire area over the conterminous U.S. declined slightly from 1960 to 1988, but increased dramatically since then at a rate of nearly a half million acres per year with considerable year-to-year variability. The dynamic fire and vegetation simulation model, MC1, accurately captures both trends and the sudden change at 1988-89, even without including fire suppression histories. MC1 simulations of vegetation gains and losses over the U.S. in the 20th century show multi-decade 'regimes', driven by climate that affect the fuel loading and condition, especially in the West. Following the 1930s drought, vegetation in the U.S. increased during two different climate regimes, most notably during the period from 1976 to 1988. Since then, a drier period has set in and the vegetation gains of the previous decades, assisted by past fire suppression, have helped to fuel increasingly larger fires. Historical drought analyses indicate that the period from the mid-1940s to mid-1970s was unusually quiescent in terms of climate variability and wet-dry cycles. Since the mid-1970s the West has experienced two extreme wet-dry cycles. The wet cycles peaked with the 1983 and 1998 El Niños and the dry cycles peaked with the 1987-89 ocean-climate regime shift and the past few years. Yet, the recent high-amplitude interdecadal climate variability may be more the norm than the exception when viewed in the context of the past 300 years (tree ring records). The strong interdecadal variability appears to 'resonate' with intrinsic ecosystem rates of growth and decline and create extreme fire episodes.

Longterm forecasts using 7 future climate scenarios suggest increases in woody and grass fuels in the West in the 21st century, with much increased fire. Ironically, even with increased fire, woody expansion and carbon sequestration continue due to increased rainfall and CO_2 fertilization.

The Southeastern U.S. appears to be among the most sensitive regions in the world to increasing temperatures and could convert from forest to savanna or grassland through processes of drought, infestation and massive fire, if the climate warms beyond a few degrees.

Challenges are to simultaneously reduce wildfire risk in the West in the face of increasing fuel loads and to optimize ecosystem carbon storage while reducing risks of wildfire. Policies must be sought that reduce risks to critical human and natural resources, while at the same time anticipating and managing future changes in ecosystems. Policies must also be sought to reduce future risk of catastrophic conversion of forest to savanna and grassland in the Southeast.

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See the MAPSS Website: (also, follow fire forecasting link)
http://www.fs.fed.us/pnw/corvallis/mdr/mapss/

Discussion:
Several themes developed in the ensuing discussion. It was noted that in both Canada and the United States governmental forest policy is often keyed to reestablishing some "historic forest condition" usually an early seral forest condition maintained by more or less frequent low intensity wildfire. This seems to fly in the face of measured climatic trends. The question was asked "how do the agencies plan to incorporate climatic and vegetation change modeling into their various planning processes?" General silence ensued, followed by an open invitation from Ron to meet with planning teams to explore ways to integrate his modeling procedures into forest plans.

Vegetation responses to climate change as modeled reflect "potential" vegetation. The actual responses in a particular area will depend on many factors, including migration potential of plant species, and disturbance regimes. Community changes may well lag behind climate changes, especially for long-lived tree species, but in general, in the west, biomass will likely increase at least through this century. At the same time, seasonal drought stress will likely increase, with attendant increases in stress-related insect pest and disease frequency. Wildfire probabilities are likely to increase accordingly.

Ron stressed his interest in working with pathologists and entomologists to improve the models of vegetation change in response to climate change. In particular, he wants to collaborate with scientists using insect and disease prediction models. He invited interested folks to contact him directly.

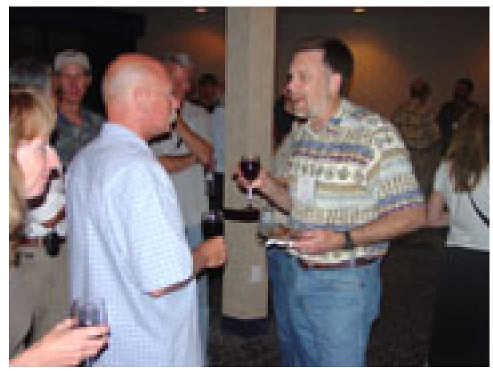
Banquet Presentation

Have Camera, Will Travel
An Evening Slide Presentation by Ron Billings, Texas Forest Service

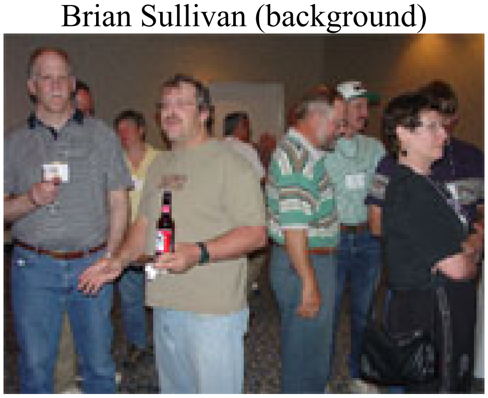
Following an excellent buffet dinner at the banquet, Ron Billings entertained the participants with a selection of his slides depicting his travels over the last 35 years. Photos of scenic landscapes, peoples, and activities were taken in various parts of the U.S. (Washington, Alaska, South Dakota, New Hampshire, South Carolina) and the many foreign countries Ron has visited (Canada, Finland, Spain, Dominican Republic, Mexico, Honduras, Nicaragua, Guatemala, Chile). The presentation ended with the most scenic of all places, Texas. Several of Ron's humorous slides were scattered throughout the presentation to keep it entertaining. Everyone enjoyed the show.

Pre-Banquet discussions; Bill Woodruff & John Kliejunas (foreground); Allison Hansen & Brian Sullivan (background)

D. Wood J. MacLean J. Dale



Tim McConnell Bruce Hostetler



Dan Gilmore and John Shaw

Tom Paine Dennis Haugen

Nylene and Ladd Livingston; Cindy and Doug Wulff

Workshops

WORKSHOPS

Concurrent Workshops – Session I

Current Status of Entomological and Pathological Research in the National Fire and Fire Surrogate (FFS) Study

Christopher J. Fettig and William Otrosina - Organizers and co-Moderators

The past effects of selective logging, fire suppression, cattle grazing and subsequent successional changes have resulted in increased fire hazards throughout much of the USA. These changes have been especially evident in western forests that were historically maintained by frequent surface fires of low to moderate intensity. In recent years, large-scale, catastrophic fires have aroused public concern, and manifested the need for well-designed treatments to reduce the scale and intensity of these events. To that end, the U. S. Joint Fire Science Program funded a nationwide study, National Study of the Consequences of Fire and Fire Surrogate Treatments (FFS), to evaluate the economic and ecological consequences of alternative fuel treatments designed to reduce wildfire risks.

This workshop included presentations by five individuals. **Dr. Christopher Fettig** (PSW – Davis) reviewed the current status of the FFS Study, and detailed the common protocols, core variables, and treatments deployed at each of the 13 sites in the network. **Dr. Andrew Storer** (Michigan Tech University) presented information based on his entomological investigations at the Blodgett Forest site, which is located on the western slope of the Sierra Nevada. To date, all pre-treatment and initial post-treatment data have been collected. Investigations are concentrating on the short-term changes in insect activity associated with each treatment, and differences among bark beetle landing rates on host and nonhost trees. **Dr. Diana Six** (University of Montana) detailed her experiences working on the Lubrecht Forest site in western Montana. A 100% census of all units was conducted. Her group in currently in the process of analyzing the data. **Dr. William Otrosina** (SRS – Athens) described the importance of the pathology discipline within FFS. He also described Patricia Maloney's efforts at the Sequoia National Park site as well as shared some of his own research on fire-bark beetle-pathogen interactions conducted in longleaf pine. **Dr. Steven Jeffers** (Clemson University) concluded the workshop with a detailed description of his pathological investigations on the Clemson Forest site located in the southern Piedmont, and Green River site located in the southern Appalachians.

Induced Insect and Disease Resistance in Trees: Scientific Curiosity or Application of the Future?

Pierluigi Bonello[1] and Jörg Bohlmann[2]

[1]Dept. of Plant Pathology, Ohio State University
[2] UBC Biotechnology Laboratory, University of British Columbia

Participants

Jim Blodgett, Karen Clancy, John Dale, Nadir Erbilgin, Monica Gaylord, Jesus J. Guerro, Peter Hall, Mike Haverty, Dezene Huber, Bill Jacobi, Bob James, Kier Klepzig, Staffan Lindgren, Ladd Livingston, Geral MacDonald, Sally McElwey, John McLean, Brice McPherson, Chris MacQuarrie, Cam Oelschlager, Tim Paine, Terry Rogers, Mark Schultz, Steve Seybold, Pat Shea, Eric Smith, Brian Sullivan, Dave Thomas, Mike Wagner, and David Wakarchuk

P. Bonello began the session with a review of modern concepts of systemic resistance in plant pathology and entomology, including systemic acquired resistance (SAR) and induced systemic resistance (ISR) to pathogens, and induced resistance (IR) to insects, including rapid (RIR) and delayed (DIR) induced resistance. All of these concepts refer to a phenomenon in which prior infections or insect feeding have been shown to induce resistance in previously non-infected or fed-upon parts of the plant. Because the nature of systemic induced resistance in woody plants is unknown, "systemic induced resistance" and its acronym SIR are used throughout this paper as a descriptor for all the different kinds of systemically induced resistance mentioned above, irrespective of specific eliciting organisms or signaling pathways (Bonello and Blodgett 2003; Bonello, Gordon, and Storer 2001; Graham and Bonello 2003).
Extensive research in the last decade has dissected the molecular basis of SIR, mostly in herbaceous model species, particularly tobacco and *Arabidopsis*. Many studies in model hosts have shown that SIR is mediated by the accumulation of the hydroxybenzoic acid derivative salicylic acid, the linolenic acid derivative jasmonic acid and the phytohormone ethylene (Sticher, Mauch-Mani, and Metraux 1997). Following hypersensitive cell death, local and systemic defense gene activation occurs, mediated by the salicylic acid/jasmonic acid/ethylene pathways. Other hormones, such as abscisic acid, can also play a role in SIR (Dammann, Rojo, and SanchezSerrano 1997).

SIR phenotypes have been observed in pine in response to Plant Growth Promoting Rhizobacteria (Enebak and Carey 2000) and pathogens (Bonello, Gordon, and Storer 2001). Limited evidence suggests that the signaling pathways in pine might differ from those of herbaceous plants. For example, local and systemic changes in phenolic composition of Scots pine needles (Enebak and Carey 2000), ponderosa pine phloem in response to a root pathogen (Bonello et al. 2003), and Austrian pine phloem in response to *S. sapinea* (Bonello and Blodgett 2003) (see below) were not associated with accumulation of salicylic acid. However, treatment of conifer tissues with either salicylic acid and its derivatives, or jasmonate, can result in enhanced **localized** resistance to pathogens (*e.g.* (Franceschi, Krekling, and Christiansen 2002;

Hudgins, Christiansen, and Franceschi 2003; Reglinski, Stavely, and Taylor 1998) and induction of expression of some defense-related genes (*e.g.* (Davis et al. 2002).

More recent experiments by (Blodgett, Bellizzi, and Bonello 2003) confirm that SIR occurs in the Austrian pine / *S. sapinea* pathosystem. Stem lesions resulting from challenge inoculations of 4-year-old plants were substantially shorter on trees in which the basal stem area had been inoculated three weeks previously with *S. sapinea*, compared with trees that received mock inoculations (Fig. 1). There was also a significant, negative correlation between challenge lesion size and lignin accumulation (Fig. 1) (Bonello and Blodgett 2003), indicating that basal

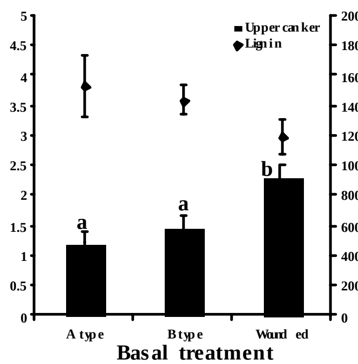


Figure 1. Significantly smaller cankers were produced in trees previously inoculated at the base with two isolates of *S. sapinea* (A and B) than in artificially wounded (mock inoculation) controls. These smaller cankers were negatively correlated with higher lignin content. Data are means ± SEM.

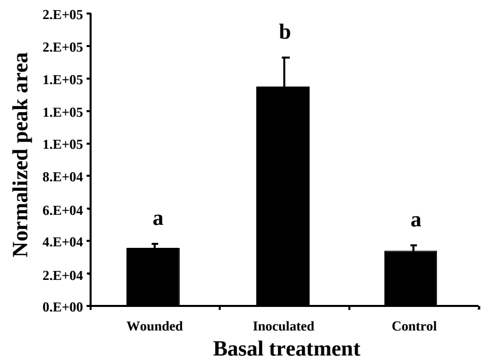


Figure 2. Systemic accumulation of a taxifolin-like compound in the phloem of Austrian pine three weeks after, and 25 cm above, the inducing basal inoculation. Data are mean ± SEM. Means with different letters are significantly different ($P < 0.001$).

inoculation significantly enhanced the intensity of the lignification response to the challenge inoculation.

In other studies, Bonello and colleagues have demonstrated systemic effects of fungal infection on phenolic pathways and the resin system of pine trees. Inoculation of mature (15-20 m tall) ponderosa pines at the base of the trunk with the root rot pathogen *H. annosum* resulted in increased levels of the soluble phenolic ferulic acid (FA) glucoside in the phloem, as well as an apparent reduction in lignin content of the phloem cell walls in presymptomatic trees (Bonello et al. 2003). All sampling occurred at breast height, *i.e.* well away from the direct influence of the pathogen, again providing convincing evidence of the systemic nature of these responses. Bonello and Blodgett (2003) also documented an up to 3-fold increase in several soluble phenolics in the phloem of 4-year-old Austrian pines 25 cm above basal inoculations, compared with wounded and non-wounded trees, including a taxifolin-like (based on its UV spectrum) compound (Fig. 2), and the stilbenes pinosylvin and pinosylvin monomethyl ether. This accumulation began one week after basal inoculation and was sustained for at least four weeks. Finally, Luchi et al. (2005) found that basal inoculations on similar 4-year-old trees induced an 8-fold increase in resin flow 25 cm above basal inoculations that was associated with systemic induction of traumatic resin ducts. This effect was measured three weeks after the basal inoculation. Together with the bioassay data, this evidence confirms that SIR indeed occurs in pines, and is associated with changes in secondary metabolite levels and resin metabolism. This is a *bona fide* example of systemic effects because the phloem was sampled at least 25 cm from the primary treatment site, well away from the primary lesion, in areas where the pathogen was never recovered.

How does all this evidence apply to natural environments? Does SIR have an ecological role in woody plant ecosystems? Bonello et al. (2001) demonstrated that actual resistance can be induced systemically in Monterey pine in the field using mechanical inoculations with the pitch canker pathogen, *Fusarium circinatum*. That induced resistance was sustained and intensified with boost inoculations over the course of at least one and a half years. In more recent work, Gordon et al. (personal communication) have compared the susceptibility of native Monterey pines to *F. circinatum* in areas that had a long history of heavy disease pressure and areas that were, and had been, disease free for the known past. Trees growing in areas with a history of disease were significantly more resistant to the pathogen than trees in disease free areas, perhaps suggesting that the presence of the pathogen had resulted in an immunization process over time. McNee et al. (McNee et al. 2003) demonstrated that *H. annosum* induced decreased feeding by the bark beetle *Ips paraconfusus* in areas away from the infection point when the insect was confined to logs of infected but presymptomatic trees, suggesting induction of systemic resistance against this insect by this root pathogen.

Based on the evidence reported above, Bonello suggests a hypothesis predicting a dynamic interplay between trees, microbes and herbivores, underscored by SIR which can be sustained or transiently expressed, depending on the damage level resulting from the induction event (Fig. 3). The results of experimentation to test this hypothesis will shed new light on the ecological significance of SIR, at least in conifer-mediated interactions between pathogens and insect herbivores.

In conclusion, the evidence suggests that SIR in conifers may have some ecological and evolutionary implications:

1) It is plausible that traits favoring deployment of inducible defenses at large temporal and spatial scales (given the longevity and size of trees) have been selected for to confer adaptive advantages to trees.
2) By definition, these defenses must be of a general nature, to allow trees to withstand attack or minimize damage by different "herbivores", including microorganisms, arthropods, parasitic plants, and even verbebrates.
3) This does not preclude the concurrent evolution of more specific defense responses based on a gene-for-gene interaction (*e.g.* white pine blister rust).

Is SIR applicable in forest settings? Not at this point, and perhaps never. However, if the nature of SIR is clarified, perhaps induction of SIR using signaling molecules will allow for better pest control in more managed settings, such as urban landscapes, nurseries, etc. If that approach is ever possible, there will probably be a tradeoff between induction of defenses and growth, such that a management decision would have to be made in one or the other direction, consistent with the Growth / Differentiation Balance Hypothesis of Herms and Mattson (Herms and Mattson 1992).

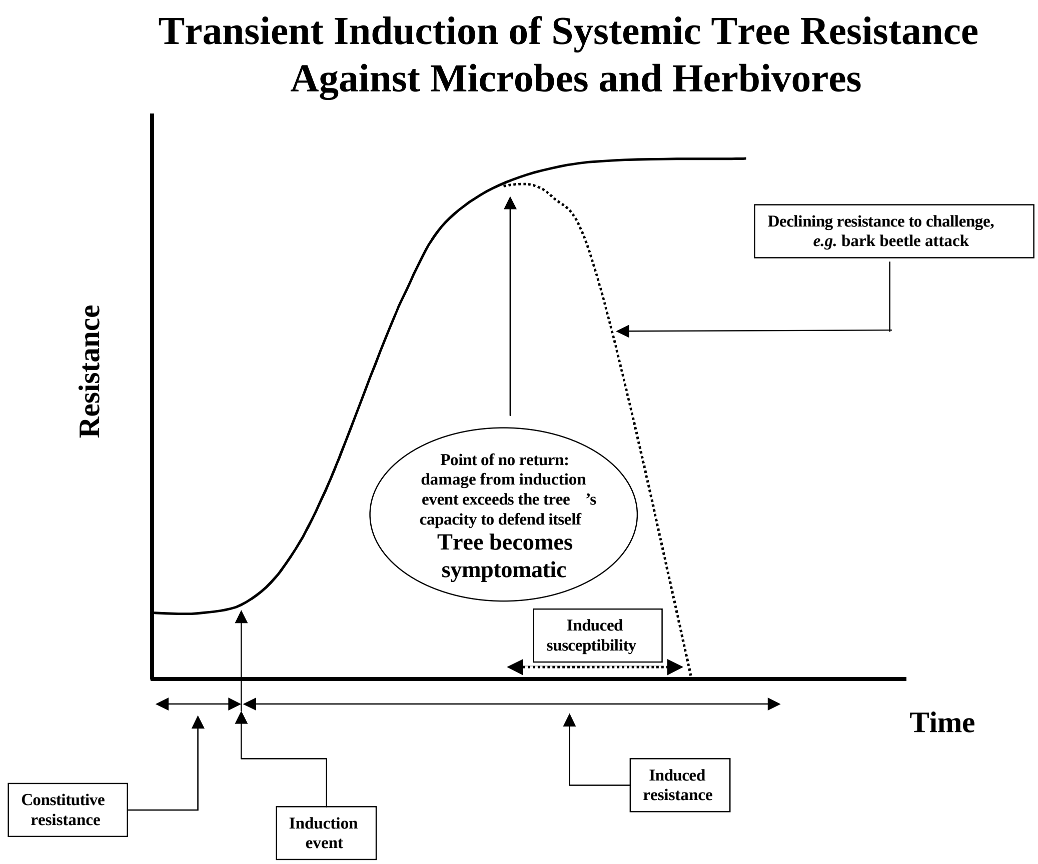


Figure 3. Diagrammatic representation of interplay between systemic induced resistance and induced susceptibility in trees against microbes and herbivores. A baseline level of constitutive resistance is present in all trees, but an induction event, e.g. infection with a root pathogen, is predicted to induce SIR against both microbes and insects. SIR is predicted to remained sustained for extended periods of time, unless the induction event results in severe impairment of the tree's defensive machinery, with subsequent collapse of tree resistance and expression of induced susceptibility. An example of this would be pines infected with a root pathogen. Initially, i.e. in presymptomatic stages, the pines would be more resistant to bark beetle attack and infection by bark beetle-associated fungi. If the pine becomes symptomatic, then resistance begins to decline and results in the often observed increased susceptibility of symptomatic, root diseased pines to bark beetle infestation.

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Bohlmann gave a 30 minute presentation of the induction of terpene synthase genes in conifers.

Monitoring the Health of the Forests of the United States

Borys M. Tkacz, National Program Manager, Forest Health Monitoring Program, United States Department of Agriculture - Forest Service, Washington, DC

Introduction

The health of forest ecosystems of the United States (US) has gained popular attention in recent years because of concerns about air pollution, global climate change, native and exotic pests, and long-term resource management. Federal and state agencies have been working together since 1991 to develop a national program for monitoring and reporting on the status and trends of forest ecosystem health. The Forest Health Monitoring (FHM) program uses data from ground plots and surveys, aerial surveys, and other biotic and abiotic data sources and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems. FHM covers all forested lands of the US through a partnership involving the USDA Forest Service, State Foresters, and other state and federal agencies and academic groups. The major FHM activities include:

- **Detection Monitoring** – nationally standardized aerial and ground surveys to evaluate status and change in condition of forest ecosystems;
- **Evaluation Monitoring** - projects to determine extent, severity, and causes of undesirable changes in forest health identified through Detection Monitoring;
- **Intensive Site Monitoring** – to enhance understanding of cause-effect relationships by linking Detection Monitoring to ecosystem process studies and assess specific issues;
- **Research on Monitoring Techniques** – to develop or improve indicators, monitoring systems, and analytical techniques;
- **Analysis and Reporting** - synthesis of information from various data sources to produce issue-driven reports on status and change in forest health at National, Regional, and State levels.

The following abstracts describe several recent Evaluation Monitoring projects funded by the FHM program.

Detecting Sudden Oak Death in Oregon's Forests

Ellen Michaels Goheen, USDA Forest Service, Central Point, OR,
Alan Kanaskie and Mike McWilliams, Oregon Department of Forestry, Salem, OR,
Everett Hansen and Wendy Sutton, Oregon State University, Corvallis, OR, and
Nancy Osterbauer, Oregon Department of Agriculture, Salem, OR

Alerted to the situation in California, monitoring for Sudden Oak Death (SOD), caused by *Phytophthora ramorum,* began in the summer of 2000 with a series of ground-based plot and roadside surveys that were done in the tanoak forest type in Southwest Oregon. No SOD was found. In July 2001 a cooperative state and federal aerial survey was flown in what was perceived as the high risk zone for SOD. Our risk assessment was based on host type, proximity to the coast, and proximity to main travel corridors between Oregon and California; approximately 338,000 acres were surveyed. Patches of dead tanoak were observed and mapped. A helicopter survey was done to provide accurate GPS locations for dead trees, and ground checking that included isolations in the field was completed for all mapped sites. Nine patches of SOD were confirmed. Located in Curry County near the city of Brookings, SOD patches ranged in size from 0.5 to 12 acres, totaled approximately 40 acres and occurred on private non-industrial forestland, private industrial forestland, and on federal forest land administered by the Coos Bay District, Bureau of Land Management. A nine-square-mile quarantine zone was immediately established by the Oregon Department of Agriculture and cooperative efforts between state and federal agencies to eradicate the pathogen were begun.

Additional surveys in the high risk zone were conducted in October 2001. New SOD finds were limited to single trees on the edge of known sites and were confined to the regulated area. In July 2002 the entire range of tanoak in Oregon was flown; only a few new infested areas within the regulated zone were found. Since that time it has become routine to conduct summer and fall fixed-wing surveys across a large scale and two additional helicopter surveys focused on the regulated area and adjacent acres each year. Newly mapped infested areas remain small (one to two trees) and relatively close to previously infested sites. The finding of an infected tanoak 1.8 miles north of the nearest previously known site has recently caused the regulated area to be expanded to 11.5 square miles.

Additional monitoring associated with SOD in Oregon includes intensive monitoring of eradication sites, permanent plots established in forests surrounding treated areas, monitoring vegetation in campgrounds and along popular trails, soil baiting, insect collections, rainfall trapping, and stream water baiting. Findings include: 1) Symptom expression and recovery of *P. ramorum* from sprouts is greatest in the rainy season and rare in summer, 2) *P. ramorum* is rarely recovered from soil and usually from soil associated with an infested stump, 3) Infected sprouts are usually associated with stumps of trees known to be infected before cutting, and 4) Stream water baiting is a useful tool for monitoring *P. ramorum*. Despite new occurrences of *P. ramorum* in Southwest Oregon forests since the initial 2001 find, distribution remains limited to a small area near Brookings and treatments to eradicate the pathogen will continue.

Evaluation Monitoring in the West of White Pines and White Pine Blister Rust Disease

Jeri Lyn Harris, USDA Forest Service - Rocky Mountain Region, Denver, Colorado

This is a brief summary of recent Evaluation Monitoring (EM) projects with 5-needle pines and white pine blister rust disease in the Interior West and West Coast Regions of the Forest Health Monitoring Program. Most of these surveys were examining limber, whitebark, and bristlecone pines. These slow growing, multi-stemmed pines grow at high elevations in sites that are difficult to access. Specific distributions, densities, and pests of these trees are not well known in general forestry. Land managers are concerned about the extensive decline and mortality of 5-needle pines throughout the West from various insect and disease agents.

E.Goheen *et al.* produced a General Technical Report for the USDA Forest Service on their work of "The status of whitebark pine along the Pacific Crest National Scenic Trail on the Umpqua National Forest – 2002". They found 46% of the whitebark pines surveyed were alive but infected with white pine blister rust, and 10% of the surveyed trees were dead. They commented that "maintaining the whitebark pine component in this area seems critical in light of its importance on certain microsites and in root disease centers. Our overall impression after completing this investigation is that whitebark pine in the survey area is more seriously threatened by white pine blister rust than previously believed."

J.E. Taylor and D.C. Atkins used Forest Inventory and Analysis (FIA) data to characterize the condition of whitebark pines Montana. By examining FIA data for Montana from 1994-'98, they were able to characterize the whitebark pine stands for compositions, canopy structure, tree sizes and some mortality agents of mountain pine beetle and whitepine blister rust.
D.Omdal and M.K. Ricklefs looked at white pine blister rust infections in Western white pines on state lands in Washington. They surveyed 72 units in 7 regions of Washington State, especially noting "canker classes" and if pruning of cankers was protecting against disease progression. White pine blister rust was found in all surveyed units with an average incidence of 42% infected trees; the pruning did not appear to be very effective. They concluded that "damage on state lands was high despite planting of genetically enhanced stock; the benefit of planting western white pine will be to maintain genetic diversity."
Monitoring white pine blister rust spread and establishment in the Central Rocky Mountains is an ongoing project by J.L. Harris and J.T. Hoffman. They surveyed whitebark, limber, bristlecone, and southwestern white pines in Idaho, Wyoming, Colorado, New Mexico, Utah, Nevada. Eastern Idaho and Western Wyoming contained sites with 90% of the trees infected with the rust; Colorado had only a 3% infection of surveyed sites. Kelly Sullivan and Jim Blodgett found the first infected bristlecone pine along with other new infections in southern Colorado during this survey.
D. Hildebrand, D. Doede, and R.Shoal found 21% of whitebark pine clumps infected with white pine blister rust on the Olympic National Forest and 62% of the whitebarks infected on Mount Hood National Forest. Aerial survey and FIA data were used for finding whitebark pine sites and their survey provided more information on whitebark site characteristics, distributions, and damages to these trees.
B. Lockman *et al.* are creating a database for the distribution and condition of whitebark and limber pines. This database uses Arcview – ESRI programs with an interactive mapping system to retrieve all available data for a specific map location. It is currently distributed on cd with plans to make it accessible over the Internet.

White pine blister rust EM projects continue in 2004 with studies for:
- monitoring the status and condition of whitebark pine in the Greater Yellowstone Ecosystem,
- monitoring white pine blister rust in the Central Rocky Mountains,
- an assessment of white pine blister rust on high elevation white pines in California, and
- more study of 5-needle pines in Washington and northern Oregon (emphasis on high elevation whitebark pine stands).

Health of Interior West Region Forests: The Ongoing Saga of Drought, Bugs and Fire

Tom Eager, Forest Health Management, USDA Forest Service, Gunnison, Colorado

Drought conditions have persisted throughout much of the interior west since at least 1996. Some climatologists believe that this dry spell is a harbinger of a "mega-drought," a period of low moisture that will occur over a course of decades. In support of these predictions several facts are evident: that the period from the 1970's to the mid 1990's was one of the wettest on record, and recent weather data indicates that available moisture has been significantly reduced throughout the West.

This drying trend has been accompanied by a marked increase in fire activity throughout the interior west. While a certain amount of the increased fire is due to the fire exclusion policies of the 20th century, weather conditions have combined with fuel conditions to create a landscape highly prone to the outbreak of wildfire. This situation has resulted in more large fires than ever, with record events occurring throughout the region.

The combination of drought and stand conditions has also resulted in some dramatic changes within the biotic component of the landscape. Bark beetle activity has increased in nearly all cover types throughout the West, with tree mortality appearing on an unprecedented scale. This situation is typified by the widespread pinyon mortality occurring throughout the western landscape.

The pinyon/juniper cover type is one of the most prominent features of the arid inland West. While there are a number of different species of pinyon pine and juniper that comprise this cover type, the appearance of the pinyon/juniper cover type is remarkably similar over vast areas; short, globular trees spaced at varying intervals in hot, dry places. Despite their penchant for these arid landscapes, recent conditions have placed the pinyon pines under even more stress than before the drought.

Throughout a six state region (Colorado, New Mexico, Arizona, Utah, Nevada and eastern California) pinyon pines under drought stress have fostered an enormous outbreak of the pinyon ips (*Ips confusus* Coleoptera:Scolytidae). Although these insects have long been recognized as a significant cause of mortality in pinyon pines, the current outbreak is unprecedented in scale and intensity. Within the affected areas, many millions of trees have suddenly died.

In order to gauge the effect of the pinyon ips outbreak, a cooperative project between Forest Health Protection units from the affected region was initiated in 2003. This project was supported both technically and financially by Forest Health Monitoring. The project utilized aerial survey and a ground plot system to derive data that would depict the enormous impact of the outbreak. The results of this work will enable workers to quantify the effects of the outbreak and determine the long-term impacts of this landscape-altering event.

Workshop: Spruce-Fir Forests and their Problems

Moderator: Fred Baker

Fred introduced the ecology of spruce-fir forests. Spruce-fir forests are susceptible to bark beetles, root disease and windthrow, and susceptibility generally increases with tree age, size, and density. These factors drive stand structure toward an increasingly uneven-aged stand. The biological agents behind these driving factors include the root fungi *Heterobasidion annosum*, *Armillaria ostoyae, Inonotus tomentosus, Phaeolus schweinitzii*, the fir engraver beetle, western balsam bark beetle, Douglas-fir beetle, spruce beetle and the defoliators Douglas-fir tussock moth and western spruce budworm. The organisms interact to form pest complexes, responsible for many of the forest health crises in our western forests. As mortality occurs, fuel loads increase. Because of their shade tolerance, most species retain their lower branches, providing ladder fuels that facilitate crown fires. Spruces and firs have thin bark, and are often killed by the fires, even surface fires. Shade intolerant pioneer species, such as aspen, often dominate the overstory for several decades following such disturbances. Eventually shade tolerant spruces and firs are recruited through gaps in the canopy and eventually predominate.

With that introduction, Brian Aukema presented results from a study of population dynamics of spruce beetles: implicating changes in fungal frequency at different levels of scale (with Richard Werner, Kirsten Haberkern, Barbara Illman, Murray Clayton, and Ken Raffa.) Spruce beetles vector several fungi, some of which may aid in nutrition, compete with developing beetles, assist in overcoming host resistance, or have other functions. This fungal complement may vary with population phase of the beetle. The ophiostomoid fungus *Leptographium abietinum* was the most prevalent during three years of sampling on the Kenai Peninsula of Alaska, followed by *Pesotum* spp. C and F. We found seven other fungi in low abundances. The frequency of association of *L. abietinum* and *Pesotum* sp. C varied with population phase. At the beetle level, there seemed to be competitive exclusion between the *L. abietinum* and the *Pesotum* species. Variation in fungal complement was greatest beetle to beetle. There was little variation among sites, and moderate variation among trees within sites.

A lively discussion ensued among the 22 attendees. Balsam wooly adelgid was added to the list of players, where it is eliminating subalpine fir and grand fir from Idaho forests. Typical of most discussions, the topic shifted, to the abnormal behavior of bark beetles during drought, and how this seems to increase with disturbance.

Population Dynamics of Spruce Beetles: Implicating Changes in Fungal Frequency at Different Levels of Scale

Brian Aukema[1], Richard A. Werner[2], Kirsten E. Haberkern[1], Barbara L. Illman[3], Murray K. Clayton[4] and Kenneth F. Raffa[5], (1) University of Wisconsin, Department of Entomology, 345 Russell Labs, 1630 Linden Drive, Madison, WI, (2) USDA FS (retired), Forest Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR, (3) USDA, Forest Products Laboratory, One Gilford Pinchot Drive, Madison, WI, (4) University of Wisconsin, Department of Statistics, 1210 West Dayton St, Madison, WI, (5) University of Wisconsin-Madison, Department of Entomology, 345 Russell Labs, 1630 Linden Drive, Madison, WI

Spruce beetles in western North America can periodically cause extensive mortality in contiguous stands of mature spruce. Like most bark beetles, they vector several fungi, some of which may aid in nutrition, compete with developing beetles, assist in overcoming host resistance, or have other functions. This fungal complement may vary with population phase of the beetle. We surveyed spruce beetle for three years throughout the Kenai Peninsula of Alaska across a range of population densities, and examined levels of variation in their fungal associates. The ophiostomoid fungus *Leptographium abietinum* was the most prevalent, followed by *Pesotum* spp. C and F. We found seven other fungi in low abundances. We used a multilevel generalized linear mixed model to examine the effects of beetle-fungal associations on population phase of the spruce beetle. The frequency of association of *L. abietinum* and *Pesotum* sp. C varied with population phase. At the beetle level, there seemed to be competitive exclusion between the *L. abietinum* and the *Pesotum* species. Using variance components modeling, we examined the relative sources of variation. Variation in fungal complement was greatest beetle to beetle. There was little variation among sites, and moderate variation among trees within sites. These variance estimates can be used to develop practical sampling strategies for future studies.

Concurrent Workshops – Session II

Wood-destroying Organisms in the New Millennium: Where Have We Gone since Bend 1989?

Michael Haverty, Chemical Ecology of Western Forest Insects, PSW Research Station, USDA Forest Service, Albany, CA
and
Jessie Micales-Glaeser, Center of Forest Mycology Research, Forest Products Laboratory, USDA Forest Service, Madison, WI

At the joint meeting of the Western International Forest Disease Work Conference and the Western Forest Insect Work Conference, held in Bend, OR, on September 13, 1989, a symposium was convened entitled "Current Research on Wood-destroying Organisms and Future Prospects for Protecting Wood in Use." Presentations were made by three pathologists and nine entomologists. At that time the taxonomy of wood-decay fungi was primarily based on morphology; new techniques using genetic and immunological tests were introduced. Nondestructive evaluation for detection of wood decay and presence of termite infestations was put forward as a new concept. The idea of termites as beneficial organisms was discussed; they provide habitat for wildlife in Australia. Cuticular hydrocarbons were debuted as taxonomic characters for species determination in termites. Agonistic (not agnostic) behavior in termites was described as a means of differentiating colonies and species. Tunneling behavior of subterranean termites was discussed in the context of baiting. The use of baits for direct control of mound building termites in Australia was examined. The behavior and ecology of exotic subterranean termites in Canada was discussed and contrasted with native populations in the United States. Finally, the development of slow-acting pesticides and their role in baiting technology for control of subterranean termites in the United States was presented. These subjects provided the basis for presentations at this meeting in San Diego, CA, in 2004.

Wood-destroying Fungi – Beyond Bend 1989

Jessie Micales-Glaeser, Project Leader, Center of Forest Mycology Research, Forest Products Laboratory, Forest Service, USDA, Madison, WI

Dr. Micales-Glaeser gave an overview of research progress in the field of forest products pathology, concentrating on five major topics that were presented at the Bend, OR meeting as major research needs. These topics were: 1) education of users to reduce losses from decay; 2) development of nondestructive testing techniques; 3) new ways of protecting wood, including biological control and changes in wood chemistry; 4) development of new wood preservatives to replace toxic biocides that are being removed from the market, and 5) increased knowledge of wood decay fungi. Two additional topics that were not of major concern in 1989, but which are significant today, are the new awareness of molds and their possible health effects, and the devastating impact of *Meruliporia incrassata* in California.

Information is much more available to users of forest products than it was in 1989, due to development of the Internet. Many universities, federal laboratories in the U.S. and Canada, and providers of forest product materials have excellent websites that provide information about wood decay and how to increase the durability of forest products. The Advanced Housing Center at the Forest Products Laboratory (FPL) has become a clearinghouse for information about housing issues, including information on durability and moisture. The Internet must be used with caution, however, because of misinformation and commercialism disguised as scientific information.

Development of nondestructive techniques for evaluation of decay and measurement of engineering properties has progressed greatly since 1989. Techniques include stress-wave and acoustical analysis. Theoretical research is being conducted with x-rays, gamma radiation, and penetrating radar. Scientists at the FPL have developed a prototype scanner that uses acoustical waves to analyze decay in living trees. This tool would be a major aid to forest pathologists for hazard tree analysis. An immunological method of minimally destructive testing, in which a small amount of sawdust is removed from a structure and analyzed for a latent decay with monoclonal antibodies, will be commercially available soon.

New ways of protecting wood are being devised. Wood-plastic composites are used commonly and are engineered for diverse applications. This material is quite resistant to decay, but can be heavy and may pose disposal problems. Current research emphasizes using natural materials, including chicken feathers, to increase the hydrophobicity, and thus durability, of wood composites. Biological control has not succeeded for the control of wood decay, however, it is being used for the control of sapstain. Logs incubated with Cartapip®, an albino strain of the blue stain fungus *Ophiostoma piliferum*, are resistant to colonization by other blue stain fungi and do not become discolored by fungal growth.

Development of new, effective, environmentally safe wood preservatives is a top priority. Many of the traditional preservatives, including penta and the arsenical salt CCA, have been banned and/or removed from the market. None of the currently accepted preservatives are as effective as penta or CCA. There is an increasing use of borates, copper-containing compounds, quaternary ammonium salts, and organic biocides. These can be used alone, or in combinations with other co-biocides, to offer some degree of wood protection. For the past several years the FPL has focused on the potential of N,N-(1,8-naphthaloyl)hydroxylamine (NHA) as a wood preservative and termiticide. NHA has a very specific mode-of-action that targets the metabolism of wood decay fungi; it effectively precipitates calcium in wood and prevents colonization by decay fungi. NHA is also toxic to termites and has been patented and licensed as a termite bait. The disposal of preservative-treated wood remains a major environmental problem.

DNA sequencing technology has greatly improved our understanding of wood decay fungi, and is being used to study the genetics and taxonomy of these organisms. It is now possible to sequence fungal DNA directly from wood and use established databases to identify many decay fungi. This is very useful for ecological studies of fungal succession in forests. Much work still needs to be done to define species and generic concepts and to develop sequence databases based on properly identified cultures and specimens.

A new concern has developed within the past five years: the prevalence of mold on wood and its possible health effects. This situation has been exacerbated by the media, large insurance settlements, and misinformation on the Internet. The presence of mold is indicative of a moisture problem, and the most effective control is long-term moisture management. Medical studies have shown that mold can be associated with allergies and asthma in sensitive individuals, but larger fears of cancer, memory loss, and bleeding of the lungs are unfounded. Development of effective mildewcides, that can be used when wood is in a high moisture area, could help alleviate this problem.

A situation that has recently evolved is the presence of the "dry rot" fungus *Meruliporia incrassata* as a major decay agent in California. This fungus is extremely destructive. *M. incrassata* can conduct water over large distances to the site of decay through a system of water-resistant, thick, hyphal strands called "rhizomorphs." This fungus is very difficult to control once it becomes established. Unfortunately, little research is being done on control strategies due to the closure of the University of California Forest Products Laboratory.

Forest products research has progressed significantly in the past 15 years. Many new products are now available that can help improve the durability of wood and wood products, and more information on wood protection is now available to the consumer. Wood is a renewable resource, and research needs to continue to make it a cost effective and desirable structural material.

Using Genetic Markers to Infer the Breeding System of the Subterranean Termite, *Reticulitermes hesperus*

Kirsten A. Copren, Department of Entomology, University of California, Davis and PSW Research Station, USDA Forest Service, Albany, CA

Due to the cryptic nature of subterranean termites, mating systems and colony genetic structure of these insects are relatively unknown. Dr. Copren compared results of delineating colony boundaries using behavioral bioassays with the results from genetic markers in a single population of the western subterranean termite, *Reticulitermes hesperus*. Using microsatellites, a hierarchical genetic analysis was performed by measuring colony and population genetic structure to examine mating systems within colonies. This population consisted of 30 colonies sampled from 36 collection points. Colonies can be delineated unequivocally using microsatellites, but bioassays using agonistic behavior are much less reliable. The population consists of many small colonies with discrete boundaries that can be located very close to one another. 27% of these colonies exhibited inbreeding via neotenics and 73% were simple families headed by a single, monogamous pair. Values of inbreeding were significantly greater than zero in the entire population, but were greater in families with neotenics. Relatedness coefficients of colonies did not deviate greatly from that expected for diploid families consisting of full siblings.

Foraging

Brian T. Forschler, Department of Entomology, University of Georgia, Athens, GA

The term "foraging" conjures visions of war-time action. Yet to those interested in social insect biology, foraging involves the accumulation of individual actions that culminate in feeding dependent castes, thereby ensuring survival of a colony. Webster's Third College Edition (1988) defines foraging as "the search for food or provisions." The terms foraging and foragers, used within the context of a subterranean termite (*Reticulitermes* spp.) colony, usually refers to the movement of termites between established feeding sites and termites collected at a feeding site, respectively. A discussion regarding the potential that task allocation, within the worker caste, would have in changing our view of the role of foraging when interpreting ecological data was proceeded by a presentation of results of a 2-year study of a community of subterranean termites in a woodland site in the southeastern U.S. This study demonstrated seasonal feeding intensity and significant movement and intermingling of subterranean termite species.

Use of the term foraging with respect to subterranean termite biology illustrates the need for more detailed information concerning termite communication. Consideration of a termite colony as a whole organism, without regard to task specificity, makes it easy to understand the role of foraging (the exploitation of food resources). Under this construct termites retrieved from natural food sources or monitoring devices are foragers because they are obtaining food for the betterment of the whole colony and are assumed to be garnering additional resources at unidentified sites. An alternative view, assuming task specificity, takes a more mechanistic view in which individual 'tunneler' termites build extensions of the gallery network emanating from a food source. In this task-related view only the tunnler termites are appropriately called foragers. Other termites, including feeding/grazing colony members, as well as brood, brood-care workers, soldiers, and reproductives, are recruited to, and eventually occupy, a resource previously identified by foragers (tunnelers). Accepting the hypothesis of separate tasks within a subterranean termite worker force requires one to reconsider using the term forager when describing termites collected at a feeding site, whether a log or a monitoring station. Perhaps it would be useful to discuss appropriate descriptive terms to use, such as recruits or colonizers. However, polyethism has not yet been unequivocally demonstrated in *Reticulitermes*. Yet knowing that most social insect societies allocate tasks within the worker caste, task allocation should be identified using intact colony test units versus the randomly or size-related groups tested in past experiments. Ultimately a better understanding of the mechanics of subterranean termite foraging, within the context of their social organization, would be useful in developing risk assessment categories for integration into termite IPM programs, as well as discussions of social evolution.

Termite Detection

Vernard Lewis, Div. Insect Biology, University of California, Berkeley, CA

Dr. Lewis reviewed advances in termite detection since 1989. He emphasized problems resulting from missed inspections and infestations hidden behind walls. Although visual inspections continue to be the mainstay for searching for termite infestations by the structural pest control industry, there are few studies that attest to the efficacy of this method. Dr. Lewis' personal experience in California suggests that many infestations go undetected mainly due to wall coverings, inaccessible areas, and other obstacles to visual searches. Advances in termite detection have been proposed and commercially marketed in the past 15 years and include microwaves, infrared, and X-ray technology. Unfortunately, little has been published on the accuracy of these detection technologies. The combination of detection devices, especially X-ray and acoustic emission (AE), has caused some excitement among pest control professionals and researchers. However, field evaluations are lacking. A field study now being conducted in southern California may provide useful information of detection efficacy and ease of use of X-ray and AE equipment. Still unknown is the level of acceptance of these new detection technologies by termite inspection and treatment professionals. An unresolved issue is how, or if, the federal and state agencies will regulate detection technologies, particularly those that may be perceived as dangerous, such as microwaves and X-ray. How the public will respond to, and accept, new termite detection technologies remains unknown.

Wood Treatments and Termite-resistant Building Materials

J. Kenneth Grace, Department of Plant and Environmental Protection Sciences, University of Hawaii at Manoa, Honolulu, HI

Termites continue to represent a major threat to wood-based materials. In Hawaii, the number of established termite species has doubled within the past decade, with the most recent invader being *Coptotermes vastator*, congener of the notorious Formosan subterranean termite, *Coptotermes formosanus*. Wood preservative treatments are required for structural lumber in Hawaii. The most common treatment for wood in protected, above-ground use is disodium octaborate tetrahydrate (DOT), marketed as Hi-Bor. For exposed situations, or soil contact, chromated copper arsenate (CCA) was the most popular treatment, although penetration was poor in Douglas-fir lumber. However, as of January 1, 2004, CCA is no longer produced. Another arsenical treatment, ammoniacal copper zinc arsenate (ACZA, marketed as Chemonite), is still available, but has limited popularity due to the dark color that it imparts to treated wood.

On a nation-wide basis, there are currently 11 commercial DOT-based preservative products, and there is still considerable interest in "fixing," or at least slowing down diffusion of, boron in wood. One sodium silicate borate product (Envirosafe Plus) is currently marketed as having these characteristics. Most of the void for exterior applications left by the demise of CCA has been filled at this time by alkaline copper quats (ACQ), with at least three commercial products available. Copper azole has also claimed a smaller part of this market, and copper citrate will probably be available in the not too distant future. Finally, usage has expanded slightly for copper naphthenate (on the industrial side, particularly for utility poles) and copper-8-quinolinolate (on the consumer side). Organic preservatives, held in check for many years by the relatively low cost of CCA, are currently a growth area in R&D.

In the absence of arsenic, the current copper-based preservatives are largely repellent to termites, rather than toxic. Laboratory and field results are quite promising, but are relatively short-term at this point. The longevity of this repellent mode of action is not yet known. As with DOT, the Formosan subterranean termite requires higher copper concentrations for efficacy than do other termite species found in the United States.

Currently, there is great interest in new wood composite materials, such as thermoplastics and cement-based products. These are resistant to termite attack, although termites will remove wood particles if they can physically reach them. However, possibly the largest growth in construction materials in the past several years has been with non-wood products: steel framing (which now has approximately 40% of the construction market in Hawaii), plastic siding and fencing, and now plastic interior building products as well. As long as these products are hard enough, or the surface is not sufficiently abraded for termites to grasp them with their mandibles (i.e., as long as they are hard and polished), they have a high degree of termite resistance. This market growth is a challenge to the wood industry, as it searches for efficacious and cost-effective preservatives.

Evolutionary Aspects of Forest Insect-Fungus Interactions

Moderator: Kier D. Klepzig, Southern Research Station, Pineville, LA

This session of informal presentations and discussion focused on forest insects and their associated fungi. In particular, presenters emphasized the evolutionary implications of these symbioses. Five speakers gave informal presentations of 10 to 20 minutes in length. Each presentation was followed by a brief question and answer session with the workshop attendees (of which there were approximately 40). The presentations are summarized below.

Pestis Symbiotica: Symbiosis Red in Tooth and Claw

Kier D. Klepzig, USDA Forest Service, Southern Research Station, Pineville, LA
Co-authors: Matt P. Ayres, Rich W. Hofstetter, Maria J. Lombardero, John C. Moser

Symbioses are common in nature. Most of these interactions are mutualisms and commensalisms. Pestilence to plants is usually the result of extreme fluctuations in plant infecting/ infesting organisms. These fluctuations can be affected by endogenous and exogenous factors. Commensalisms and mutualisms, in particular, tend to destabilize systems. In considering the above, and in light of other evidence, we propose that symbioses promote the evolution of pestilence. We title this theory - *Pestis symbiotica*.

1. Mutualisms and commensalisms are common among plant pests: In classification of quarantine pests, in Europe 47% and in the US 45% could be classified as mutualists or commensalists.
2. Though symbioses tend to be mutualisms and commensalisms, the science of ecology tends to give these interactions scant attention. In major ecology texts these interactions receive minor emphasis (39/585, 19/410, 2/187 of the total number of pages). A recent Biosis search revealed that, of publications since 1995, 23,000 dealt with predation, only 2,300 dealt with mutualism.
3. Plant pestilence is usually the result of extreme fluctuations in plant enemies.
4. These fluctuations are wrought by complex endogenous or variable exogenous effects.
5. Commensalisms and mutualisms destabilize population dynamics.
6. Thus, it is possible that symbioses promote pestilence in evolutionary time.

- In conclusion, many plant pest complexes are emergent properties of symbioses.
- Managing plant pestilence involves understanding plant pest interactions.

Linking Ecology and Evolution: Mite-fungal-beetle Interactions in Southern and Mexican Pine Beetle Communities

Rich W. Hofstetter, Department of Biological Sciences, Dartmouth College, Hanover, NH
Co-authors: Kier D. Klepzig, John C. Moser, Matthew P. Ayres.

Dendroctonus frontalis are obligate mutualists with two symbiotic fungi (*Entomocorticium* sp. *A* and *Ophiostoma ranaculosum*). This association has implications to the beetle's host breadth, geographic range, population dynamics, and competitiveness. Evolutionary implications of these interactions concern community stability/persistence, fluctuating selection (genotypic) limitations, and the coevolution of mutualist guilds associated with the beetle. There are, as well, interactions between mutualistic and non-mutualistic fungi (for example, *Ophiostoma minus* is an antagonist
of *D. frontalis* - *O. minus* in phloem negatively affects beetle larvae (via allelochemic effects, asymmetric competition). The ecological implications of these interactions to the beetle's population dynamics are context dependent.

Some questions which arise in the study of beetle fungus mutualisms:

- Mutualist guild (diverse phlyogenetic background, morphological similarities)
  - What are the onsequences of associating with diff. species?
  - How do competing mutualists coexist?
  - Do "cheater" species; jeopardize persistence of legitimate mutualists?
  - Is there active partner choice/ exclusion (by one or both?)
  - What are the relative contributions of horizontal vs vertical transfer?
  - What mechanisms promote specialization versus generalization in mutualistic interactions?
  - Do other species (e.g. the tree) constrain evolution of interactions between mutualists?
- Beetle-fungal mutualism altered by third species
  - Does the 3rd species benefit from either partner? Positive or negative effect on one or both mutualists?
  - Are mutualisms constrained by evolution of beetles or fungi with other species?
  - Does spore transport by mites increase heterogeneity of mutualist fungi?
  - Do third species (mites) promote "cheater" species?
  - Is there a relationship between the evolutionary age of a mutualism and the likelihood that it is mediated by other species?

Bark beetle-fungus Symbioses: Determining Evolutionary Histories

Diana L. Six, Department of Ecosystem and Conservation Sciences, College of Forestry and Conservation, University of Montana, Missoula, MT

Our understanding of mutualism lags well behind that of other interaction types and is still mostly limited to two-species interactions. Two species interaction studies are critical first steps in describing mutualisms, however, to gain a more accurate view of these interactions we must broaden our focus to look at mutualisms within a multi-species context. The dynamics of mutualists are influenced, and sometimes largely determined, by the dynamics of species external to the mutualism. In addition, many symbioses involve multiple symbionts, indicating that not only interactions with the host, but among symbionts, must also be considered. To truly understand relationships among *Dendroctonus* bark beetles and their symbiotic fungi, a multi-species approach will be necessary.

These symbioses are complex. Effects of fungal symbionts on *Dendroctonus* hosts are complex and range from mutualistic to antagonistic. Structures specialized for disseminating fungi (mycangia) have evolved independently at least three times, allowing comparisons of symbioses within and among lineages. Furthermore, associations among *Dendroctonus* and fungi are oligophilic, with beetles associated with more than one fungus [ascomycetes (*Ophiostoma*), basidiomycetes (*Entomocorticium*) and ascomycete yeasts]. These symbioses are further complicated by the presence of alternate vectors: mites phoretic on *Dendroctonus* that possess structures analogous to beetle mycangia (sporothecae) that carry spores of some fungi also associated with their beetle vectors. These "shared" fungi are mutualistic with the mites, but vary from mutualistic to antagonistic with the beetle vector. It is clear, given the complexity of these symbioses, that a multi-species approach will be required to accurately characterize them.

A particularly powerful method for gaining insight into symbioses is to compare phylogenies of hosts and symbionts. Congruence among phylogenies can indicate a long shared evolutionary history among the two groups of organisms, while points of incongruence can indicate host switching, "missing the boat", or speciation of symbionts independent of their hosts. Using such an approach can help us determine the evolutionary histories of these symbioses and to what degree are they affected by host phylogeny and life history. Furthermore, if phylogenies of all symbiont groups associated with a particular host group are developed, one can begin to determine to what degree the different groups have interacted over evolutionary time.

I am currently involved in a project to develop a molecular phylogeny of the *Ophiostoma* associates of *Dendroctonus* for comparison with a phylogeny of the host beetles. Future work with collaborators is planned to develop phylogenies of the other associated fungal groups and mites for future comparisons. Using this multi-species approach will allow a broader and more accurate interpretation of how these symbiotic assemblages formed, are maintained, and evolve over time.

Ancient Quadripartite Coevolution in the Attine Ant-microbe Symbiosis

Cameron Currie, Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS

Leaf cutting/ fungus growing ants benefit from their interactions with fungi via the provision of nutrients. Their fungi benefit via ant-provided dispersal, substrate for growth, and protection. These symbioses have a New World distribution; they are a monophyletic (Attini) but diverse group (13 genera and ~210 species). Ants can use different substrates for cultivating fungus, most of these fungi are in the family Lepiotaceae (Agaricales). The fungi are clonally propagated, and there is some lateral transfer between nests.
Out initial questions were:
Are ant fungus gardens host to virulent parasites?
Have parasites coevolved with the ants and their cultivar?
We found that *Escovopsis* is a virulent parasite of fungus gardens, it reduces garden growth rate and worker production, and it is lethal to garden if not controlled. Ants use behavioral defense mechanisms and antibiotics to control this parasitic fungus. The antibiotic comes from a third mutualist – a filamentous bacterium. In addition, the ant possesses structures and glands it uses to culture the bacteria. Still key questions remain. What is the role of additional lineages of organisms within well studied symbiotic associations? Are antibiotic-producing bacteria present in other insect-fungal associations? A number of people have aided in this work: Matias Cafaro, Ainslie Little, Emily Magee, Lacey Loudermilk, Hannah Reynolds, Stephen Taerum, Michael Poulsen, Nicole Gerardo, Johan Billen, Koos Boomsma, Dave Malloch, Ulrich Mueller, Steve Rehner, Ted Schultz, James Scott, Neil Straus, Bess Wong. Funding has been provided by NSF, the University of Kansas and NSERC.

Another (Putative) Evolutionary Point to Ponder

John C. Moser, USDA Forest Service, Southern Research Station, Pineville, LA

In studying southern and Mexican pine beetles in the Chiricahua Mountains in Arizona, we came across an apparent Clerid mimic, *Arhaphe cicindeloides* Walker. This Largid bug was caught in a WPB baited Lindgren trap, near XPB/SPB-infested *Pinus leiophylla*, May 05, 2002, Turkey Creek, Cochise Co. AZ. The insect was collected by Bobbe Fitzgibbon. I discussed the possibility that other insects might be mimicking clerids and reviewed mite discoveries from other bark beetles.

Bugs, Basidiospores, and Fiber: The Role of Silviculture in Maintaining Healthy Forests

Moderator: Daniel W. Gilmore (dgilmore@umn.edu), University of Minnesota

The purpose of this workshop was to provide a forum for discussion that integrated pathology, entomology, and forest management – specifically silviculture. There were 35 individuals who attended the session included several people from the USDA Forest Service Forest Health Monitoring Washington office. This session generated substantial discussion from attendees. The purpose of this summary is to provide a record for those that were unable to attend this workshop. I will attempt to provide a narrative of the presentations and discussion that captures major points. Abstract from the panel members along with their respective e-mail addresses are also provided.

Gilmore led the workshop with a discussion of how the definition of silviculture has changed since the inception of the discipline. He stressed the necessity of management by objective or desired future condition. In doing so, he emphasized that the three planned components of a silvicultural system (i.e. regeneration, tending, harvest) must be tailored to achieve the desired objective of management. He then noted how societal demands on the forests have changed since the inception of forestry in North America. Early foresters focused their management on “taming” the irregular forests and converting them to production forests. Foresters of today now have the task of creating forests with a desired future condition that resembles the early forests. In essence, they have been asked to create irregular forests from production forests.

Gilmore then stressed the importance of the local adaptation of silviculture practices. He provided an example with of red pine and the impact of the pine engraver (*Ips pini*) following thinning treatment. *Ips pini* is an insect that is almost always present in red pine stands throughout its range. It spends the winter in the forest litter, lays its eggs in the red pine slash, and when conditions are ideal, can produce multiple generations that are capable of killing drought-stressed red pine trees via mass attack. Drought stress in red pine rarely occurs in the central and eastern portion of its range. But, at the edge of its range in Minnesota there is a high risk of mortality from the bark beetle following thinning during drought years. Thinning red pine stands between August and March minimizes the presence of fresh slash in the late spring and early summer and is the best preventative method for minimizing tree mortality from this insect. In addition to the timing of harvest, one of the best ways to reduce the susceptibility of a pine engraver epidemic is to keep stands in a vigorous condition. This is best achieved by keeping basal area levels below 120 square feet per acre.

Gilmore then introduced Lewis who placed her presentation in the context of the natural disturbance paradigm. She emphasized Gilmore’s point on changing societal values. Particular emphasis was placed on the decrease in emphasis on production forestry. In British Columbia, this shift in social values has been driven by forest certification programs that are market driven, and legislatively by the British Columbia Forest Practices Code. Lewis than presented three examples on how forest pathogens have influenced forestry practices in British Columbia.

The first example focused on red band needle blight (*Dothistroma septospora*) in lodgepole pine. The occurrence of this blight in pine has shifted the target species composition from pine-dominated to 20% pine or less in the Interior Hemlock Zone of British Columbia (Woods, 2003. Forestry Chronicle 79:892-897). The BC Forest Practices Code has been revised from favouring spruce and pine, to a mandatory requirement for more natural, and diverse, species compositions.

The second example focused on Armillaria root disease in the southern interior managed forests of British Columbia. *Armillaria ostoyae* is ubiquitous in the wetter ecosystems of the interior. In reviewing work in B.C. and elsewhere, Lewis developed a strong case illustrating that mixed-species deciduous-conifer forests had less Armillaria root disease than conifer plantations managed for productivity. Lewis emphasized the point that root diseases spread slowly and that their impact is realized slowly over time. By the time a management response is initiated, it is often too late.

The third example focused on mechanisms of spread of the root disease *Inonotus tomentosus* in undisturbed stands and plantations. The prevailing thinking has been that this fungus has been spread via root contact and that few large genotypes existed in a given stand. Recent research, however, suggests that the frequency of unique genotypes is higher in plantations. This suggests that asexual reproduction via root contact is not the prevailing mode of reproduction in plantations. Rather, this fungus is reproducing sexually. Further research is required to determine the complete life cycle of this important forest pathogen. Discussion followed on how quickly forestry legislation in British Columbia could be changed on the basis of research. Changes could and do occur within two years. Changes in actual practice, however, are slower.

Gilmore then introduced Ostry who placed his presentation in the context of changes in forestry practices. Ostry included the importance of maintaining healthy forests in the definition of silviculture. He defined forest health as “the perceived condition derived from concerns about age, structure, composition, function, vigor, resilience, activity of insects & diseases” and emphasized that a shift was needed from a “brush fire” mentality to long-term health. Ostry then presented three examples of forest health issues in the Lake States with management recommendations.

The first issue was shoot blights (*Sphaeropsis sapinea* and *Sirococcus conigenus*) with red pine. Twenty years ago, these two blights were not known. Today, *Sphaeropsis* is commonly spread via nursery stock and is a severe problem under drought conditions. *Sirococcus*, on the other hand, is common in the forest overstory and is prevalent during wet springs. Management recommendations include proper site selection, the avoidance of multi-aged stands, complete removal of the overstory, and sanitation cutting.

The second issue was eastern dwarf mistletoe on black spruce in the Midwest. Like the western dwarf mistletoe observed on the field trip, eastern dwarf mistletoe is parasitic and weakens its host thereby increasing the likelihood of mortality through other agents (e.g., bark beetles, funguses). Control measures for eastern dwarf mistletoe include the avoidance of uneven-aged stands and sanitation harvests of infection centers.

The third issue discussed by Ostry was aspen cankers and decay. Aspen is a short-lived, early successional species and has a "pathological" rotation age in the Lake States of 60 to 70 years. One of the keys to maintaining healthy aspen stands is to avoid dense stocking and to avoid wounding trees during stand tending treatments. Ostry then discussed an aspen thinning experiment underway in northern Minnesota. Treatments included 2 post-thin densities (180-200 tpa; basal area 40 ft^2 ac^{-1} and 280-300 tpa basal area 60ft^2 ac^{-1}) and an unthinned control. Treatment blocks were 5 to 10 acres in size and replicated on three sites that had uniform soils, elevation, stand density and stand age (25-32 yrs old). Preliminary results show tree wounding during harvesting results in decay. In addition, reducing the density of the stands at this age, particularly the lower density has cause frost cracking and sun scalding which has also resulted in decay.

Gilmore then introduced Baker who reinforced the concept of management by objective or desired future condition. Baker also discussed the concept of a healthy forest. Different individuals may define a healthy forest differently. For example, to an environmentalist, old growth spruce may represent a healthy forest; to a pathologist this same forest may be at high risk of blowdown; to an entomologist, it may be a spruce beetle outbreak ready to happen. A key element in the definition of forest health must include long-term sustainability.

Formal and informal discussions on a variety of topics then took place. These discussions continued among attendees of this workshop throughout the conference. I have attempted to capture the gist of these discussions below.

- Management by objective or desired future condition (DFC). It is imperative that forest managers have clear management goals specifying the type of forest that they are attempting to create through silvicultural prescriptions. Many DFCs are legislated as such the BC Forest Practices Code in British Columbia. Other DFCs are developed through consultation with stakeholders during the development of management plans. There is a disconcerting trend of selecting a DFC of pre-eurosettlement forest as a management goal. This can certainly be an option for management, but examples provided during the field trip and concluding plenary address by Dr. Neilson suggest that DFCs of a pre-eurosettlement forest are likely not achievable. Presentations and discussion during the Cedar Fire stop on the field trip revealed that fire suppression during the last half century has created a forest for which there does not appear to be a natural analog. South of the border in Mexico where there has been no fire suppression program, the forests differ in their spatial arrangement and density. Although fires occur more frequently in Mexico, fuel loadings are less and the fires are less severe. Modeling work by Neilson and his colleagues has shown that climate drives the likelihood of wildfire, and that our climate is changing in such a way for which there does not exist an analog in the historic record.
- It is important to keep forest science relevant. Lewis's presentation on how science can be used to guide forest policy and regulations was an excellent example of adaptive management. More work of this nature is needed, as is the continual training of professionals entering the field. For example, recent work in Minnesota on multi-age red pine management has been implemented by professionals unfamiliar with the red pine shoot blights (*Sphaeropsis sapinea* and *Sirococcus conigenus*) discussed by Ostry. Continued training of field personnel is important.

- The importance of maintaining the presence of the forest products industry. Healthy forests are important in maintaining a viable forest products industry, in providing a natural setting for tourism, in providing habitat for various fauna, and in maintaining water quality and other ecosystem functions. Forest management is important in maintaining healthy forests. In order for large-scale forest management to occur, there must be a viable forest products industry. In the absence of a forest products industry, the cost of maintaining a healthy forest must be borne by society. We observed an example of this in the wake of the Cedar Fire on the Cleveland National Forest in southern California. This was a 280,000-acre wildfire that burned 3,600 homes and claimed 22 lives. In the context of the forest, it caused substantial Jeffrey pine, black oak, and aspen mortality immediately northeast of San Diego. Dead trees are present throughout major travel corridors in the Cleveland National Forest and elsewhere. These trees are for the most part large (> 10 in. dbh) and cause a safety hazard along roadways. They must be removed. In addition, these trees and those that were killed away from roadways are a prime-breeding environment for bark beetles. There is no substantial forest industry (pulp mills or saw mills) in southern California. Thus, the cost of removing these hazard trees must be borne by taxpayers or property owners within the burn area. Due to the lack of a market for wood products, only hazard trees will likely be removed. Thus, there is a high probability of bark beetle epidemics (California flatheaded borer, *Ips* sp., turpentine beetle) in the Cleveland National Forest in the very near future. This problem will be exacerbated by the presence of *Fomes* and *Armillaria* fungi that have been reported in the area since the 1940s. Current control measures for the *Fomes* fungus include treating the stumps of the hazard trees felled with a borax type solution.

  Other examples of forest health problems that are exacerbated due to a lack of a forest products industry are evident throughout the United States. Northern Arizona and the entire state of Colorado have severe infestations of the mountain pine beetle. Both regions lack the infrastructure (pulpwood and sawmills) for a forest products industry. Thus, there are thousands of acres of dead and dying conifers that will be an extreme fire hazard for years to come. A slightly different pattern is beginning to unfold in the Northeast. There has been a reduction in pulp mills and sawmills in the Northeast during the last decade, but fiber is still relatively abundant. Much of the fiber, however, is currently derived from non-forest management activity such as land conversion (forestland being developed). There has been a steep decline in people employed as timber harvesters in this region during the past decade. Thus, even though fiber is available and mills are present the industry is not healthy. A healthy and viable forest product industry is important to forest health programs.

- The need for more professional forest health specialists. During the past two decades, there has been a steady increase in the number of ecologist but a precipitous decline in the number of foresters, pathologists, and entomologists employed by the USDA Forest Service (Tainter. 2003. Phytopathology 93:1056-1061). The same trend likely exists with most public agencies and to a lesser extent with industry. Academicians are observing the same trend in natural resource programs across the country. Fewer and fewer students are entering the applied undergraduate programs and graduate school. Many reasons exist for these trends. The trends observed in the professional sector can be partially attributed to a change in society's values. People now value the forest more as a recreational resource than a source of fiber and do not understand the link between forest health and forest management. The trends observed in academia can be more easily explained. The cost of attending colleges and universities has sky rocketed during the last two decades. Students and their parents now view a Bachelors degree as a long-term investment. When selecting a career path, they look at employment prospects. With fewer well-paying jobs available fewer students will be trained as foresters, entomologists, and pathologists in the future.

Forest Pathogens and the "Whoops!" Approach to Silviculture

Kathy J. Lewis (lewis@unbc.ca), University of Northern British Columbia

The definition and fundamental principles of silviculture have undergone dramatic changes initiated primarily by a society that has demanded more than just trees from managed forests. The target in silvicultural practices, as stated in forest practices legislation and requirements for certification, is to employ natural disturbance and stand development processes, such that timber is produced efficiently and non-timber forest values are sustained. However, as the importance of their role is finally being recognized, forest insects and pathogens are starting to take over as the major driving force along the road towards ecosystem-based forest management. Two examples are provided of silviculture practice changes influenced by forest pathogens. One is a serious outbreak of red band needle blight that has forced changes to species acceptability guidelines in the wet interior forests of B.C., from favouring spruce and pine, to a mandatory requirement for more natural, and diverse, species compositions. The second is a serious push towards higher acceptable broadleaf densities in Armillaria-infested forests of southern B.C., that have until recently been weeded of competing broadleaf trees to increase productivity.

Unfortunately, due to the slow to manifest, and often subtle impacts of disease agents, the need for many of these adaptations is recognized only after large numbers of trees begin to die. By then the pathogen has become well established and inoculum levels have mounted. A lack of understanding of the roles of forest pathogens in natural stand dynamics, and even of the basic biology of some pathogens, is partly to blame. As an example, recent evidence suggests that tomentosus root disease of spruce spreads much more commonly by spores than it does by root contacts. Therefore, silvicultural practices aimed at reducing root contact spread (e.g. minimum planting distances around colonized stumps), will not be nearly as effective as intended. Development of silvicultural practices to ensure healthy forests is difficult when we lack even basic understanding of mechanisms of disease spread. If silviculture is to play anything but a "come from behind" role in forest health, more effort and funds will need to be spent on identifying the contribution of forest pathogens to natural stand dynamics, and forest managers will have to pay more attention to the full rotation rather than the current focus on the reforestation phase of silviculture.

Disease Implications of Changing Trends in Silvicultural Practices

**Michael E. Ostry (mostry@fs.fed.us), USDA Forest Service,
North Central Research Station**

Native forest tree pathogens are important and necessary components in forest ecosystems, regulating energy flow, stand structure and succession, and significantly contribute to the diversity and long-term sustainability of "healthy" forests. On the other hand, these pathogens and disease outbreaks often can become damaging and interfere with forest management objectives of producing goods and services.

Few practical direct disease control treatments are available to managers, and direct control measures often are ineffective, too expensive, affect too few acres, or their results are of short duration. Silvicultural practices, however, can have profound direct and indirect effects on pathogen populations and the intensity and duration of disease outbreaks. Silviculture is well financed and can provide multiple benefits over a large area. Thus, similar to landscape scale wildlife habitat management, effective disease control has historically been accomplished using silviculture.

Forest management in Minnesota and elsewhere in the Midwest is changing. Generally, forests are being managed more intensively with less clearcutting and leaving more residual trees within harvest units. There is increased emphasis on natural regeneration, thinning, developing uneven-aged and mixed species stands, better site preparation combined with less regeneration release, and managing on extended rotations. These trends in the silvicultural systems used can result in stand conditions that can have either positive or negative effects in regard to conditions conducive for disease development and risk of damage.

Shelterwood systems, selection cuts, clearcutting, intermediate cuts and other silvicultural treatments can either reduce or increase the disease susceptibility and vulnerability of stands. Examples of major diseases in conifers influenced by silviculture include several red pine shoot and canker diseases, white pine blister rust and eastern dwarf mistletoe. Selected hardwood diseases that can be influenced by various stand treatments include Armillaria root rot and various stem decays and cankers.

Many of our disease prevention guidelines developed in the past were based on specific silvicultural systems in use at the time. Today, the silvicultural systems being considered for use in many of our major forest types have the potential to increase disease incidence and severity above acceptable levels. It is important to consider what pest complexes currently exist in management units and to be aware of their potential effects under changing stand conditions associated with various management systems.

The Role of Silviculture in Maintaining Healthy Forests: One Pathologists View

Fred A. Baker (fred.baker@usu.edu), Utah State University

Before evaluating forest health, one must define that term in an unambiguous manner. To an environmentalist, old growth spruce may represent a healthy forest; to a pathologist this same forest may be at high risk of blowdown; to an entomologist, it may be a spruce beetle outbreak ready to happen. All could be correct. Key elements in defining forest health should include sustainability and stability. The silviculturist's role is to develop a prescription that will move the stand toward a desired objective. Entomologists and pathologists must make silviculturists and forest managers aware of the consequences of proposed management alternatives. To do this we must document outcomes in stands, and communicate our observations in such a way that silviculturists can apply our learning to other landscapes.

Concurrent Workshops – Session III

Renewed Research Efforts on the Application of Verbenone and Other Semiochemicals for Reducing Bark Beetle-Caused Tree Mortality

Christopher J. Fettig, Moderator
Pacific Southwest Research Station

Verbenone (4,6,6-trimethylbicyclo[3.1.1]-hept-3-en-2-one) is the primary antiaggregation pheromone of the mountain pine beetle, southern pine beetle, and western pine beetle. It is naturally derived from three sources: (1) the beetles themselves, (2) auto-oxidation of α-pinene and subsequently cis- and trans-verbenol to verbenone, and (3) auto-oxidation from cis- and trans-verbenol to verbenone by microorganisms associated with several bark beetle species. In recent years, this semiochemical has been synthesized commercially and evaluated as a tool for mitigating stand losses due to bark beetle infestation.

This workshop included presentations by six individuals. **Dr. Robert Progar** (PNW – Corvalis) shared his recent work using verbenone for reducing mountain pine beetle infestations in lodgepole pine. In his study, verbenone was applied at a rate of forty 5g pouches/acre. Significantly fewer trees were attacked and killed in the verbenone-treated plots during the initial two years of the study. In the third year (2002), nearly twice as many trees were attacked and killed in the verbenone-treated plots compared to the untreated controls. It is hypothesized that the reduction in efficacy may be due to increases in beetle populations.

In the southern USA, verbenone is used once a southern pine beetle infestation (termed "spot") has formed to reduce future spot growth. **Dr. Scott Salom** (Virginia Tech University) presented information on the use of verbenone for managing small to moderate-sized southern pine beetle spots (Clarke et al. 1999. J. For. 97: 26-31). The technique was registered with EPA in 1998 with an elution device inadequate for operational use. A new device was developed by Phero Tech Inc., but is thought to elude verbenone at a rate too low to inhibit southern pine beetle populations. Rather than modify the device, Phero Tech Inc. has chosen to further investigate the possibility of developing a more active mixture of semiochemicals. The Southern Pine Beetle Working Group is now considering other options and companies for collaboration in developing an effective semiochemical-based suppression tool.

The operational use of verbenone to protect trees from bark beetle attack has been successful in some cases (Shore et al. 1992; Shea et al. 1992; Lindgren & Borden 1993; Progar, this session), but not others (Gibson et al. 1991; Shea et al 1992; Progar, this session). Several causes for these inconsistencies were discussed in this workshop. **Dr. Dezene Huber** (PSW – Davis and UC-Davis) presented new information on the use of angiosperm nonhost volatiles (NHVs) to augment the utility of verbenone. NHVs are known to be behaviorally-active on a variety of conifer-infesting bark beetles. The use of antiaggregation pheromones (e.g. verbenone) exploit the fact that foraging beetles tend to avoid heavily colonized trees within which intraspecific competition decreases brood production. NHVs exploit the ability of foraging bark beetles to detect and avoid nonhost angiosperm trees.

About 35 papers have been published on the response of bark beetles to NHVs with 30 appearing in press since 1995. The antennal responses of about 15 bark beetle species have been investigated, as have the behavioral responses of some 24 species (*see* Zhang & Schlyter, 2004). The behavioral responses to NHVs of each of the six economically important bark beetle species in western North America have been studied in some detail. Both the antennal and behavioral responses of three of the preceding six species are well documented. For the mountain pine beetle, various combinations of 1-hexanol, conophthorin, (*Z*)-3-hexenol, (*Z*)-2-hexenol, (*E*)-2-hexenol, hexanal, (*E*)-2-hexenal, nonanal, benzaldehyde, benzyl alcohol, and guaiacol are behaviorally active in an additive and redundant manner (Wilson et al. 1996, Borden et al. 1998; Huber et al. 1999; Huber and Borden, 2003). Conophthorin and 1-hexanol have also been shown to be active alone in the mountain pine beetle. For the Douglas fir beetle, the list of compounds active in an additive and redundant fashion is slightly shorter and includes conophthorin, 1-hexanol, (*Z*)-3-hexenol, hexanal, (*E*)-2-hexenal, nonanal, benzyl alcohol, and guaiacol, with conophthorin active alone as well as in mixtures (Huber and Borden 2001a; Huber et al. 1999, 2000b). Conophthorin is also behaviorally active in the pine engraver, and a group of four other NHVs including nonanal, salicylaldehyde, benzyl alcohol, and guaiacol act to augment the activity of conophthorin (Huber et al. 2000b, 2001). The behavioral responses of the spruce beetle, western pine beetle, and western balsam bark beetle are not well understood.

Semi-operational trials using NHVs and verbenone have provided evidence for the utility of this technique to successfully protect single pines from mountain pine beetle attack (Huber and Borden 2001b). Recent work has also shown that it is possible to protect stands of lodgepole pine from mountain pine beetle attack (Borden et al. 2003). The relative advantages and disadvantages of the use of operational mixtures of NHVs and verbenone were discussed in this workshop. Several questions demand further research. Continued work in this field should yield interesting and useful discoveries in the future.

Dr. Patrick Shea (PSW – Davis) and **David Wakarchuk** (Biota Control Inc. – Burnaby, BC) briefly discussed several verbenone release devices. Pat discussed his work with the Med-E-Cell device. The release of volatiles from the Med-E-Cell device is mechanical, and therefore largely independent of abiotic conditions. Dave discussed his recent work with Biota Control Inc., which hopes to manufacture (+) verbenone for southern pine beetle suppression in the near future.

Dr. Staffan Lindgren (University of Northern British Columbia) concluded the workshop with his valuable critique of current verbenone research efforts. In his opinion, applied research is essentially treading water as slow release formulations have been plagued with inconsistency, and operational experiments have yielded inconsistent results. Most verbenone research has been conducted in the forested environment. Consequently, we lack a sufficient understanding of the mechanisms by which verbenone affects bark beetle behavior. Staffan questions whether we haven't been putting the cart before the horse, and sees a need for increased efforts in basic research. In terms of applied research, experimental designs must be rigorous, and explicitly account for environmental factors such as stand density, edge effects, host species and climate, as well as the beetle population size. Furthermore, dispenser technology has to be reliable and affordable, and large-scale synthetic methods have to be developed. Failures caused by poor experimental designs or dispenser failure must be eliminated before resource managers will view the use of this promising tool favorably.

What's New in Graduate School? Research Presentations by Students in Entomology and Pathology

Tom J. Eager, Forest Health Management, USDA Forest Service, Gunnison, CO

A series of six presentations were made by graduate students from throughout the western United States. A short synopsis is given below.

Using Ant (Hymenoptera: Formicidae) Functional Groups as Bioindicators of Forest Health in Northern Arizona Ponderosa Pine Forests

S. Sky Stephens, Northern Arizona University, Flagstaff, AZ

Reintroduction of fire and thinning has been suggested as the main practices to regain forest health in ponderosa pine forests of northern Arizona. Recent silvicultural programs and the occurrence of catastrophic wildfires have created a range of disturbance severities and a mosaic of forest conditions. Sixteen stands were randomly selected to create a completely randomized experimental design with four treatments including: 1) unmanaged, 2) thinned, 3) thinned and burned, and 4) wildfire, with four replicates of each treatment. I assessed changes occurring in ground foraging ant functional groups at the stand scale as related to these treatments. A pitfall trapping scheme was implemented during the summer months of 2002 and 2003. A total of 18,009 specimens were collected representing 20 species from ten genera. I found that traditional biodiversity measures, such as species richness, diversity and dominance were a less satisfactory measure of treatment impact on ants than functional group analysis which allowed us to consider the ecosystem role of each species. I found that different functional groups were dominant under different levels of disturbance severity and suppressed or excluded other functional groups that were less suited to the disturbance intensity. Maintaining a diversity of habitat types has been suggested for supporting ecological diverse ant functional groups as indicators of forest health.

Air Pollution and Insect Outbreaks

Michele Eatough, University of California, Riverside, Riverside, CA

I studied the influence of air pollution on two insect outbreaks. Four years of severe drought led to unprecedented bark beetle activity in ponderosa and Jeffrey pine in San Bernardino of Southern California. Pines in the San Bernardino Mountains were also heavily impacted by ozone and nitrogenous pollutants arising from the urban areas of the Los Angeles basin. I studied bark beetle activity and bark beetle associated tree mortality in pines two drought-impacted sites in the San Bernardino Mountains, one receiving high levels of atmospheric pollutants, and one with more moderate atmospheric input, with nitrogen addition treatments of 0, 50 and 150 kg/ha/yr at each site. Tree mortality and beetle activity were significantly higher at the high pollution site. Differences in beetle activity between sites were significantly associated with ozone injury to pines. Tree mortality increased 8% and beetle activity increased 20% under the highest rates of nitrogen additions at the low pollution site. The strong response in beetle activity to nitrogen additions at the low pollution site is evidence that atmospheric deposition of nitrogenous pollutants could increase tree susceptibility to beetle attack at the high deposition site. Fruittree leafroller on California black oak showed the opposite response to nitrogen additions. During spring of 2000 many oak in the San Bernardino mountains were heavily damaged by leafrollers. In May, as the leafrollers completed development, control oak were significantly more damaged than fertilized oak. Leafroller abundance was significantly negatively correlated with total foliar carbon. Carbon based defense chemistry may have decreased in fertilized oak. Further investigation showed that in April, newly opened, expanding buds of fertilized oaks had significantly longer leaves, indicating that leaves of fertilized trees had developed faster than leaves on control trees. I hypothesize that rather than being influenced primarily by plant chemistry, which would predict better leafroller performance on fertilized trees, leafroller performance was effected by plant phenology, and early instar leafrollers performed better on the more closed and protected buds of the unfertilized oak.

Towards a Phylogeny of *Matsucoccus*: an Enigmatic Genus of Scale Insects

Janie Booth, Entomology Department, University of California, Davis, Davis, CA

Scale insects, while often being serious forest pests, are one of the least understood groups of insects by most entomologists. Scales are in the superfamily Coccoidea, order Hemiptera and are closely related to whiteflies, psyllids, and aphids. There are approximately 22 extant families with most species belonging to the families Coccidae, Pseudococcidae, Diaspididae, Eriococcidae, and Margarodidae. Scale insects are difficult to identify because most features required for identification are cuticular. In order to observe important morphological features, specimens must be cleared of wax and microscope slide-mounted. Adult females are commonly used for identification because other life stages are either ephemeral or tend to be morphologically conserved.

For my graduate research, I am examining the systematics of North American members of the genus *Matsucoccus* (Margarodidae). This genus, found only on *Pinus*, contains several pests such as *M. acalyptus* on pinyon pines in the Southwest, and *M. matsumurae* in Connecticut and other parts of the eastern seaboard on *Pinus resinosa*. My project focuses on creating a phylogenetic tree based on morphological and molecular data. I have begun sequencing the D2 expansion region of the large subunit ribosomal DNA gene (28S). I have also created a list of potentially useful morphological characters. Understanding interspecific relationships should aid in characterizing and managing *Matsucoccus* outbreaks.

Potential for Using Monoterpenes in an Integrated Pest Management program for *Conophthorus ponderosae* (Coleoptera: Scolytidae)

Brian M. Shirley, University of Idaho, Moscow, ID

Several monoterpenes present in *Pinus ponderosae* Laws were examined as possible synergists for pityol, the male sex attractant pheromone of *Conophthorus ponderosae* (Coleoptera: Scolytidae). The study site was near Whitebird, Idaho in a ponderosa pine seed orchard managed by the BLM. Yellow Japanese beetle traps were baited with the various compounds and monitored every two weeks. Traps baited with pityol plus (+)-α-pinene and traps baited with pityol plus 3-carene had higher male beetle catches than all other treatments (no females were caught in the traps). Traps baited with myrcene plus pityol had male beetle catches similar to the unbaited control traps. The results led to exploring myrcene as a possible repellent of *C. ponderosae*.

To test repellency, 18 individual ponderosa pine trees (separated by > 20 m) that had at least two, one year old cone clusters were examined. One cone cluster per tree was designated as a no treatment control and the other was treated with a single vial of myrcene attached at the base of the cluster. The clusters were monitored every two weeks for attack by *C. ponderosae*. The cones were collected in mid-July and were dissected in the laboratory to examine brood survival.

Cone clusters treated with myrcene were not attacked in the first two weeks of the study while 44% of the untreated controls were attacked in the first two week period. Only 17% of the myrcene treated clusters were attacked 4 weeks into the study while 67% of the untreated controls were attacked. By the end of the study, 61% of the myrcene treated clusters were attacked and 78% of the untreated, control clusters were attacked. The reduced rate of beetle attack on cones treated with myrcene implies some repellency by myrcene. The eventual increase in attack on the treated clusters is probably due to the myrcene in the vial degrading and not the effectiveness of myrcene as a repellent wearing off over time. Work is continuing on the repellency of myrcene with the same sample design except that the vials are replaced every 3-4 weeks, rather than one vial per treatment for the entire experiment.

The results of this study could aid in the development of an IPM strategy against *C. ponderosae*. Beetle populations could be monitored using traps baited with pityol plus wither (+)-□-pinene or 3-carene. When populations reach a threshold density, myrcene could be used to disrupt attack by female beetles. More research is needed to better understand these interactions but the results are promising for the possibility of a pheromone-based IPM strategy for use in managing populations of *C. ponderosae.*

Bark Beetle and Dwarf Mistletoe Interactions in Northern Arizona.

S. C. Kenaley, Northern Arizona University, Flagstaff, AZ

With the high incidence of southwestern dwarf mistletoe (*Arceuthobium vaginatum* subsp. *cryptopodum*) in ponderosa pine forests of northern Arizona, the *Ips* spp. (Coleoptera: Scolytidae) outbreak in 2002 provided an opportunity to study bark beetle and dwarf mistletoe interactions. Two studies were conducted to specifically address the severity of dwarf mistletoe infection on ponderosa pine and its relationship with bark beetle infestation. The first study was a pair-wise comparison of dwarf mistletoe ratings (DMR) between live and recently killed ponderosa pines in areas infested by *Ips* spp. The second study was an evaluation of ponderosa pine mortality in 2002 and attributed to bark beetle infestation. Collectively, the results indicated that ponderosa pine mortality was greater in less productive stands and in trees moderately to severely infected with dwarf mistletoe. In addition, severely dwarf mistletoe-infected trees within the intermediate crown class comprised the greatest percent of observed mortality.

Multistate Research Project W-187: An Example of an Integrated Approach to Studying the Impacts of Insects and Diseases in Forest Ecosystems

Barbara Bentz and Diana Six, co-Moderators

Historical Perspective of Regional Research Project W-110 / W-187: Interactions among Bark Beetles, Pathogens and Conifers in North American Forests

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The Land Grant Colleges of the United States participate in a series of projects that are intended to provide answers to problems that are important across broad geographic areas. These Regional Research Projects, now termed Multi-State Research Projects, are developed by teams of investigators that come from many different institutions and are important for standardizing experimental methods and analyses to provide research based solutions to issues that may cross specific systems or crops. The Regional Research Project W187 (nee W110) has a history that spans 32 years and began as a truly interdisciplinary cooperation between Experiment Station forest pathologists and forest entomologists to understand and manage bark beetle outbreaks in the western United States.

The genesis for Regional Research Project W110 came from the observations that bark beetle infestations were frequently associated with stressed trees and that these high risk trees were often found to be suffering from a variety of root diseases. Forest pathologists and forest entomologists from Land Grant Universities in the western United States met together and drafted the initial plans for the establishing the Regional Research Project. In addition to the pioneering interdisciplinary research that focused on tree infection, pathogenicity, and tree susceptibility in root disease centers, the members of the Regional Research Project were fundamental in determining the chemical communication among bark beetle species and in characterizing how stressed trees are discovered, how the colonization process is mediated by semiochemicals, and how species of beetles partition available resources.

During the middle years of the Regional Research Project, an additional interdisciplinary focus was added to the program. Investigators had discovered that many of the tree killing species vectored specific fungi on their exoskeleton and within specialized structures (mycangia) on their bodies. Members of the W110 made significant contributions in determining the species associations among beetles and the vectored fungi and characterizing their ecological relationships, including the nutritional contributions of some fungi, the role of the fungi in the colonization process, and the interactions between the fungi and the host trees.

After 20 years of ground breaking interdisciplinary research, the Project underwent a major expansion in focus and participation. The science had matured and the emphasis took a national perspective. In a paradigm shifting meeting in New Orleans, the Project underwent a transformation to include Land Grant University scientists from across the country, scientists in the U.S. Forest Service, and international scientists. A systematic approach to interdisciplinary science was developed around four overarching objectives and based on critical interactions between the biotic and abiotic components of the environment and across multiple trophic levels. This new and more inclusive approach became the basis for the evolution of Regional Research Project W-110 into W-187.

The current participants in W-187 range from founding members through at least four academic generations. This, in itself, is evidence of the academic and intellectual strength of this Project. The concepts continue to be refined and explored as new information is developed. New voices and new eyes bring vitality and new approaches to understanding the relationships among trees, beetles, and fungi. Molecular approaches and biotechnology are allowing researchers to draw new connections and relationships. Finally, the introductions of invasive species into North American forests are changing those relationships in unexpected ways. Regional Research Project W-110/ W-187 will continue to make invaluable contributions to our understanding of relationships among organisms at levels that range from molecular to landscape and to be an unrivaled model of interdisciplinary cooperation and collaboration.

Bark and Ambrosia Beetles Associated with Coast Live Oaks Infected by *Phytophthora ramorum* in Marin County, California

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Sudden oak death is caused by *Phytophthora ramorum*, an apparently exotic pathogen with a broad host range. Coast live oak, *Quercus agrifolia*, is one of the species most severely impacted in coastal California. Colonization of bleeding cankers on live coast live oaks by ambrosia and bark beetles (Scolytidae) is a notable symptom of this disease syndrome. Three-year survival curves of same-symptom cohorts in disease progression plots, established in 2000, showed that survival of trees exhibiting beetle-colonized bleeding cankers was 25%, in contrast to 90% survival for bleeding trees without beetles. Catastrophic failure of naturally-infected trees was replicated in a mechanically inoculated tree, in which extensive ambrosia beetle (*Monarthrum* spp.) tunnels were closely associated with the point of breakage. Colonizing beetles may require sound wood that is free of decay, in order to allow growth of the ambrosial fungus that developing larvae consume.

We initiated a study to evaluate the role of ambrosia and bark beetles in sudden oak death in coast live oaks. In July 2002, 80 trees were inoculated with *P. ramorum*, 40 were mock-inoculated to control for insect responses to wounds, and 40 were maintained as controls. Prior to the two beetle flight periods in each year, half of each group was sprayed with 0.2% permethrin to prevent insect colonization. Sticky traps were placed on the insecticide-treated trees to monitor beetle responses in 2003. In April to July 2003, significantly more beetles were trapped on inoculated than mock-inoculated trees. The permethrin treatment completely suppressed beetle attacks in April. Although by July, beetles had colonized the same number of both treated and untreated trees, the number of tunneling beetles was much lower on permethrin-treated trees. Traps on trees that were colonized earlier in the season collected more beetles in July than traps on the beetle-free trees. This result implies production of pheromones by the first colonizers. Through November 2003, 3 of the 64 bleeding trees had died, all following heavy beetle attacks during the year.

The four most abundant beetle species were trapped in much greater numbers on inoculated than on mock-inoculated trees. The sex ratios were heavily male-biased in *Monarthrum scutellare* and *M. dentigerum*, female-biased in *Xyleborinus saxeseni*, and approximately equal in *Pseudopityophthorus pubipennis*. The consistent association of saprotrophic beetles with *P. ramorum*-infected oaks suggests that native insects, and possible decay fungi, will influence the course of the disease in North America. We will continue to monitor the responses of trees to *P. ramorum* and to colonizing beetles. For the 2004 season, we have increased the permethrin application rate to 0.5%.

Colonization of Cut Branches of Five Coniferous Hosts of the Pitch Canker Fungus (*Fusarium circinatum*) by *Pityophthorus* spp. (Coleoptera: Scolytidae) in Central, Costal California

Nadir Erbilgin, Andrew J. Storer, David L. Wood, Thomas R. Gordon

Pitch canker is a disease of pine trees that is caused by the fungus *Fusarium circinatum.* In California, pitch canker infections occur largely as a result of the activities of insects serving as vectors of the pathogen or wounding agents of trees resulting in infection of those wounds by the pathogen. The fungus has been isolated from a number of bark beetle species, including twig beetles, *Pityophthorus* spp., engraver beetles, *Ips* spp., and a cone beetle, *Conophthorus radiatae*. We initiated field experiments to determine if the activities of *Pityophthorus* spp. influence the incidence of pitch canker on Monterey, Bishop, knobcone and ponderosa pines and Douglas-fir in central, coastal California. Our study sites were located in Central and Coastal California. Our treatments consisted of ten healthy branch tips (50-60 cm long) cut from each of the hosts listed above and attached to the lower canopy of these conifer species. For each site, branches cut from each pair of tree species were placed on both heterospecific and conspecific host trees; thus each experiment consisted of two tree species and four treatments. Each experiment was repeated once every year from 2001 to 2003. After about ten weeks, branches were brought to the laboratory, and placed into rearing tubes at room temperature and 24 h light. Emerging insects were collected, sorted, counted, identified to species, and placed on a pitch canker selective medium. Tips of all five host trees were inoculated with *F. circinatum* to determine susceptibility of trees to the pitch canker pathogen. A total of 2,413 beetles emerged from infested branches put in rearing tubes. *Pityophthorus* spp. made up 93% of total catch. The remaining 7% were deathwatch beetles, *Ernobius punctulatus* (Coleoptera: Anobiidae). Among emerging *Pityophthorus* spp., *P. setosus* (66.4%) and *P. nitidulus* (23.1 %), and *P. carmeli* (6.7%) were the most abundant species. Monterey (60.1% of branches), Bishop (90 %) and ponderosa pines (61.7 %) were heavily infested by *Pityophthorus* spp. Infestations on Douglas-fir (26.7 %) and knobcone pine (23.3%) were relatively low. We found significant differences between the mean number of *Pityophthorus* spp. emerged from Monterey pine branch tips placed on Monterey pine trees and from Monterey pine branch tips placed on Bishop pines. The similar trend was observed in Monterey-ponderosa pine experiment. Monterey pine branch tips placed on Monterey pine trees were significantly more attractive to Monterey pine branch tips placed on ponderosa trees. Emergence from other branch species was similar. We did not isolate the pitch canker propagules of progeny emerging from cut branches. Mean lesion length resulting from inoculations on branches of 5 host species varied only between Monterey and ponderosa pines and Monterey pine and Douglas-fir, in each case Monterey pine had longer lesion length than the other host species. *Pityophthorus* species composition and abundance and lesion length partially explained the low incidence of *F. circinatum* on ponderosa and knobcone pines and Douglas-firs in the current study.

Shifting Symbionts

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The mountain pine beetle, *Dendroctonus ponderosae*, possesses two mycelial fungal mycangial associates, *Ophiostoma clavigerum* and *O. montium*. These two fungi have differential effects on the growth and development of their host beetle. While conducting various experiments investigating these associations, we noted that the two symbionts shift in prevalence with their hosts over time. Shifts occur over the developmental period of the beetle, over the flight period of the beetle within a single season, and potentially, from year to year overall within a population.

In one study designed to investigate which developmental stages of the beetle were associated with phloem colonized by the fungi, and thus most likely to be mycophagous, we found all stages of the beetle to be associated with fungi. We also observed that the two fungi shifted from a predominance of *O. clavigerum* associated with early developmental stages to a predominance of *O. montium* with later stages. This shift in symbionts may be due to nutritional and physical changes occurring within the tree during the year after attack that favor the growth of different fungi at different times. These results indicate that horizontal transmission of the symbionts is likely to be widespread and common, and that an individual beetle may develop with different fungi at different times.

In another study investigating what proportions of the two fungi are carried by emerging brood adults, in most populations we surveyed, we observed a shift in the two symbionts over their emergence period. *Ophiostoma clavigerum* was carried by most or all early emerging beetles.

However, as the season progressed we observed a complete shift to beetles carrying only *O. montium.*. Such a shift may again be tied to tree condition and growth preferences of the two fungi, however, it may also reflect a faster rate of development or maturation of beetles developing with *O. clavigerum.* We will be following at least one population over many years to look for whether proportions of the fungi shift from year to year.

Can Fungi Provide a Dietary Source of Sterols for *Dendroctonus* Bark Beetles?

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Many *Dendroctonus* spp. are symbiotically associated with at least one filamentous fungal species that is mutually beneficial to the beetle host, while relationships with other fungal associates may be antagonistic or commensalistic. In those associations where beetle brood growth and success is increased in the presence of fungi, a nutritional benefit is often the cause. Woody plant tissues have very few of the vital nutrients required for insect growth and associated fungi may provide an alternative source. For example, insects require sterols for normal growth, metamorphosis and reproduction, yet are unable to synthesize this organic compound, and are therefore dependent upon a dietary sterol source. Because sterol concentrations in woody plant tissues are either absent or a minor component, fungi may provide an alternate sterol source for phytophagous insects. Ergosterol (24β-methylcholesta-5,7,trans 22-trien-3β-ol) is to filamentous fungi what cholesterol is to humans, the major membrane sterol. Although ubiquitous, fungal ergosterol levels are not constant, and may change with species, age of the culture, developmental stage, and growth conditions. In studies with ambrosia beetles it was found that the most beneficial species of fungi associated with *Xyleborus* ambrosia beetles was also found to possess the greatest concentration of ergosterol.

Dendroctonus ponderosae and *D. rufipennis*, two economically important bark beetle species in western North American forests, are symbiotically associated with at least one filamentous fungal species. *Leptigraphium abietinum* (Peck) Wingf. is commonly found in specialized pits on adult *D. rufipennis* pronotum and elytra, and *Dendroctonus ponderosae* is closely associated with two fungi, *Ophiostoma montium* and *O. clavigerum*. Both species can be found on the exoskeleton of adult beetles and in specialized structures of the adult integument termed mycangia, that function in fungal transport. We compared the relative amounts of ergosterol found in these fungal associates, and tested the hypothesis that a particular fungal associate may contain significantly greater quantities of ergosterol, and thereby confer greater benefit to it's beetle host. We also analyzed ergosterol quantities in uninfested and infested host tree phloem.

We found that green host tree phloem contained 0.0 to trace amounts of ergosterol while beetle-infested phloem contained up to 0.04% ergosterol, within the levels known to be required by insects. All 3 fungal associates contained relatively large amounts of ergosterol compared to amounts found in fungi associated with ambrosia beetles. *O. montium* contained significantly more ergosterol than *O. clavigerum*, the other fungal associate of *D. ponderosae*,. These results suggest that *D. ponderosae* and *D. rufipennis* most likely obtain required sterols from their fungal associate.

Concurrent Workshops – Session IV

Biological Control and Forest Pest Management: A Tribute to Donald L. Dahlsten

December 8, 1933 – September 3, 2003
Photo from University of California Statewide IPM Program, J. K. Clark, photographer

Robert F. Luck Moderator
Department of Entomology, University of California, Riverside

Don's initial academic pursuits were athletic. His high school achievements in sports, especially his football prowess, earned him an athletic scholarship to UC Santa Barbara. However, Don's affliction with polio during his sophomore year left him with recurrent pain and a permanent handicap, prematurely ending his athletic career. He subsequently switched to a career in biology, which culminated in a faculty position in the Division of Biological Control, at the University of California Berkeley where he specialized in forest and urban forest entomology and biological control. I first met Don while he was a Teaching Assistant for a forest entomology course taught by Professor Ronald W. Stark and (then Assistant) Professor David L. Wood. Because of that course, I minored in entomology and pursued a Master's and a Doctoral Degree in Entomology, the latter as Don's second graduate student. Don profoundly influenced my research focus and orientation.

As a graduate student, Don studied under Prof. R. W. Stark and D. L. Wood. Don's dissertation research focused on the bionomics of *Neodiprion* sawflies. He graduated from Berkeley in 1963 and accepted a position at California State University, Los Angeles, that fall. While teaching at CSU Los Angeles, he applied for and was offered a position in UC Berkeley's Division of Biological Control. In 1964, he began his academic career at Berkeley and established his laboratory at Gill Tract, the location of UC Berkeley's once extant Division of Biological Control.

His first year as an academic at Berkeley, 1964-5, was eventful and involved several converging political and environmental issues which shaped Don's subsequent research focus and interests. The first of these events was the Free Speech Movement that erupted during the fall of 1964. The second event involved the 1963 publication of Rachel Carson's *Silent Spring* and its subsequent condemnation by the Entomological Society of America. This latter issue involved a close vote in 1965 by the faculty and graduate students in the Department of Entomology at Berkeley which supported the condemnation. Don was one of a handful of faculty members that opposed it. These two events, coupled with the publication of *Pesticides and the Living Landscape* by Robert L. Rudd in 1964, shaped Don's activism and research focus for the rest of his career. It also crystallized his lifelong involvement in the policy and ethics of pest management in general and of forest and urban pest management in particular. It led him to question the general need for pesticide use in pest management.

His opposition to the general use of pesticides for insect control was affirmed soon after he initiated his field research as an academic. It involved an aerial application of DDT applied to kill *Neodiprion* sawflies infesting young white fir trees on the Modoc National Forest. Although these trees were a source of income as Christmas trees for the National Forest, Don's experience with these sawflies indicated that the revenue lost from their defoliation did not justify the cost of such applications. Moreover, he suspected that unrecognized detrimental side affects arose from such applications, particularly to the natural enemies of forest defoliators, including their effects on cavity nesting birds such as the mountain chickadee. An outbreak of the Douglas-fir tussock moth (DFTM) in the mid-1970s, also aerially treated with DDT, led to his long-term commitment to investigate this moth and its management. His subsequent research developed a detection method for sub-economic DFTM populations; documented DFTM's associated natural enemy complex; evaluated augmentative releases of *Trichogramma* spp for its suppression; and investigated the mountain chickadee's effects on DFTM populations, including the use of supplemental nesting sites.

In early experiments Don tested whether supplementing nesting sites increased mountain chickadee densities and, if so, whether their increases led to decreased defoliator densities. He censused the abundance of a cavity nesting bird in replicated plots of 50 bird boxes spaced at two densities, 50 and 100 meter intervals, including a set of plots without nesting boxes in his experimental design. He used sentinel DFTM cocoons and egg-masses to assess apparent bird predation on DFTM. He also determined the mountain chickadees' diet by analyzing their stomach contents. Don found that chickadees were the dominate occupant of the supplemental nesting boxes and that more nesting boxes led to more birds per acre. Insects were a major component of the chickadee's diet, which included adult scarabs, large Lepidoptera larvae, and sawflies such as needle-chewers (*Neodiprion* spp.), web-spinners (*Acantholyda* spp.), and bud miners (*Pleroneura* spp.). Sucking insects were also eaten, including a surprising finding: incense cedar scale (*Xylococculus macrocarpae*) was heavily preyed upon in winter. This Margarodidae was important in the chickadee's winter survival and the birds likely provided biological control of this potential pest. Insects were also the predominant food fed to the nestlings. Don also found that chickadee predation of DFTM eggs was density dependent, indicating that the bird's predation was potentially important in the biological control of DFTM. With only 1 egg mass out-planted per tree, 20% of these egg masses were preyed on. With five egg mass per tree, 66% were preyed on. At 10 egg masses per tree, predation was 71%.

Moreover, Don found that increasing the nesting sites for the chickadee increased predation of larval defoliators and miners, including DFTM predation. His life table analyses of immature chickadee survival also showed that it was variable, often substantial, and was related to nesting densities.

Don also had a diversity of professional interests including pest management, forest management, urban pest management and biological control. He took a similar long-term commitment to his research on the management of bark beetle populations for which he is perhaps more widely known. But it was his ecological ethics and lifelong commitment to understanding these complex systems that provided an example for those of us he mentored. And that mentoring did not end with our fledging. We are very fortunate to have benefited from his scientific contributions, and from his constant prodding for ethical science. He was more than a good friend who will be sorely missed. His example and legacy will live on in those of us he mentored and it obligates us to pass on these values to those with whom we interact and mentor.

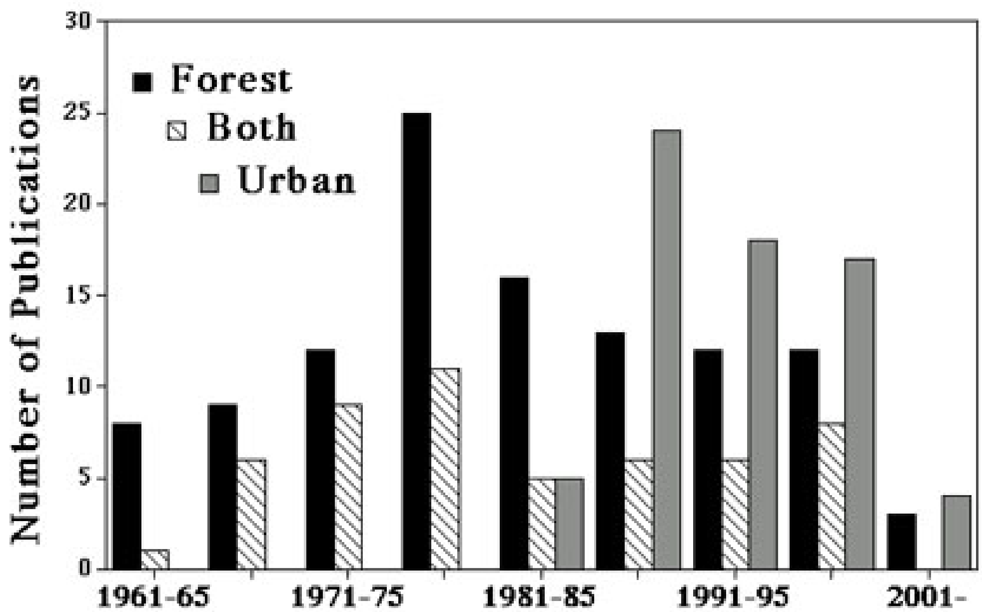


Figure 1. Donald L. Dahlsten publications categorized as on forest, urban, or both environments.

Legacy of an Educator: A Tribute to Donald L. Dahlsten

Andrew B. Lawson, Plant Science Department, California State University, Fresno

Don Dahlsten wore many hats during his long career: entomologist, ornithologist, educator, and administrator. The themes of Don's work and friendships were generosity, stewardship for the environment, concern for the "little guy," and a passion to share knowledge of science and the environment–especially through real life experiences.

Through UC Berkeley's College of Natural Resources, Don helped found and conduct two of the College's most successful public outreach programs: City Bugs and Team Oakland. Through the Environmental Leadership Outreach Program's Team Oakland, Don helped develop courses in urban environmentalism. After school and on weekends he worked with underprivileged youths in the City of Oakland. Students were brought to the Berkeley campus and into the field for hands-on learning experiences in their own backyards. Don mentored youths who otherwise would have had little exposure to urban ecology or college academia.

City Bugs enlisted Oakland public school teachers and students to develop interactive lesson plans on insects for grades K-12. Learning emphasized the ecology of urban insects and common pests. Youth were taught basic entomology, such as how to make an insect collection. Don helped to develop a major Web site (www.cnr.berkeley.edu/citybugs) with profuse illustrations and photographs on the identification and biology of urban arthropods. His contributions included a popular online "ask the experts" service.

Forest entomology, environmental biology, insect ecology, and ecological methods were popular UC Berkeley courses developed and taught for many years by Don. Each ecological methods course included a half dozen major field trips, exposing students to a broad diversity of applied biological research and potential career opportunities. Typical ecological methods field trips included:

- Parlier in the heart of California's San Joaquin Valley to experience production agriculture.
- Blodgett Experimental Forest to study forest management.
- Strawberry Creek to measure surface water quality and the role of aquatic invertebrates as environmental indicator species.
- Bodega Marine Laboratory to measure resource partitioning.
- The Lake Tahoe basin to observe grazing and assess livestock impacts on streams.
- The Sonoma or Monterey County UC Cooperative Extension offices to observe how the University transfers knowledge to professional users outside of the campus environment.

Don was major professor to 39 graduate students, an active Committee member to dozens more, and a committed mentor to hundreds. He fought for the "underdogs," never failing to help even difficult students, such as those who had been "cut loose" in frustration by their former academic advisors. Don treated everyone as his colleague, whether you were a high school biology student assisting with his field work or one of many well-established scientists from around the world who came to work in his lab. Don gave us science and culture, and entertainment and friendship. The opera, A's baseball games, Cal football, fine dining, and good red wine, were among the many experiences Don generously shared with his "Ducklings." Much more than an academic education or how to conduct good research, Don taught us character, commitment, humility, and the importance of personal relationships.

He will be deeply missed by all of his students.

The Urbanization of a Forest Entomologist: A Tribute to Donald L. Dahlsten

Steve H. Dreistadt, Statewide IPM Program, University of California, Davis

Although well-known as a forest entomologist, Don Dahlsten was keenly interested in urban trees. Don grew up in the city. He was raised in Los Angeles, studied at UC's urban Santa Barbara and Berkeley campuses, and he taught a year at Los Angeles State University before joining the Berkeley faculty. Ron Stark reminisced about Don as a graduate student in the 1950s: "Dahlsten was an impressionable city boy…I remember John McSwain and I swapping wild animal stories (mostly fibs) and then scarring Don by sneaking up on him after a trip to the loo."

Although a profligate publisher on forest insects for over 40 years, many of Don's early papers pertained to both forest and urban trees, such as insect problems in forest recreation areas and conifer damage from photochemical smog. The growth of Don's interest in urban forests is evidenced by a chronological tabulation of 230 of his publications categorized as on forests, urban trees, or both (Figure 1).

In an early project with his second graduate student, Don investigated a dramatic pine needle scale outbreak at South Lake Tahoe during the mid-1960s. Bob Luck and Don found that:
- Scale outbreaks correlated with suburban areas fogged with malathion for mosquito control.
- Spray residues were highly toxic to scale parasitoids.
- Parasitoids' density-dependent responses to scales were absent within spray areas.
- Scale densities declined and percent parasitism and predation increased after spraying ceased.

Don and collaborators subsequently researched urban forest problems such as the Dutch elm disease-vectoring elm bark beetle and effects on natural enemies from malathion bait spray to eradicate Mediterranean fruit fly. Several examples illustrate the breadth of Don's urban research:

For three decades Don studied the ecology, monitoring, biological control, and management of aphids infesting urban trees, including birch, linden, hackberry, and *Liriodendron* (tuliptree). His investigations included:
- Classical biocontrol by parasitoid introductions;
- Natural enemy conservation through ant control and selective insecticides;
- Inundative release of green lacewings;
- Treatment thresholds based on efficiently monitoring honeydew;
- Insecticide disruption of biological control;
- Cultivar selection for enhanced aphid parasitism; and
- Economics of replacing problem-prone trees.

In work with Ann Hajek, their discoveries included:

• a birch tree species previously unrecognized in California;
• a birch aphid species previously unknown in North America; and
• a previously unreported host species of an aphid parasitoid.

Don investigated elm leaf beetle for over 20 years and developed:
• Damage prediction models and treatment thresholds based on binomial egg sampling;
• Degree-day timing of sampling and treatment;
• Selective treatments (*Bacillus thuringiensis*, systemic insecticides, trunk banding) and natural enemy conservation;
• Sustained classical biological control efforts emphasizing *Oomyzus* (=*Tetrastichus*) *gallerucae* introductions and biotype fitness; and
• Model IPM demonstration and education projects.

Don pursued classical biological control of psyllids infesting California pepper tree, eucalyptus, and eugenia. The eugenia project was in part funded by Disneyland, where gardeners had planted a half mile of eugenia hedges. They pruned eugenia into Mickey Mouse character sculptures, and this topiary art was the second attraction opened to the public at Disneyland. Don introduced a *Tamarixia* sp. parasitoid and developed a timed pruning based on psyllid monitoring traps, a program that now effectively manages Disneyland's' previously severe psyllid problem.

Among Don's notable contributions was the successful classical biological control of blue gum psyllid through introduction of *Psyllaephagus pilosus*. Commercial production of eucalyptus is widespread in Britain, Ireland, France, Italy, Spain, Portugal, and areas of Africa, Asia, and Latin America. Good control of blue gum psyllid was only achievable by repeated spraying at 2- to 3-week intervals. In San Diego County where baby blue gum for cut floral arrangements is grown on extremely steep hillsides, many fields could only be sprayed by helicopter. Most growers found that psyllid populations rebounded soon after treatment, necessitating up to ten applications per season.

Blue gum psyllid was first reported in California in 1991. By the end of 1992, Don had collected and imported a parasitoid, developed a rearing method, evaluated the parasitoid in quarantine, and introduced and established *Psyllaephagus pilosus* in the field. Within 3 years of psyllid introduction, Don had achieved complete biological control.

Remarkably, this psyllid for decades was a pest of eucalyptus planted around the world, yet prior to Don's successful introductions there is no record of any biological control efforts targeting it. Don often found answers where no others thought to look. Our profession and our environment have much to be grateful for because of Don.

Foreign Exploration and Biological Control: A Tribute to Donald L. Dahlsten

Dennis Haugen, Forest Health Protection, USDA Forest Service, St. Paul, Minnesota

Don Dahlsten's passion for biological control carried him to forests throughout the world. I met Don in Arkansas, as a graduate student of Fred Stephen, but Australia is where we first worked together. I was researching *Ips grandicollis* infesting Monterey pine plantations. My funding agency "encouraged" me to redirect my energies to Sirex woodwasp, *Sirex noctilio* . Don and Wayne Berisford collaborated with me and made annual trips to South Australia where we worked on this project.

I quickly discovered Don's predilection for field research in proximity to areas with fine wine production. Traveling to the field from our base at the University of Adelaide entailed passes through Coonawarra – the premier red wine region of Australia. Don took full advantage of this opportunity. He applied methodical sampling methods and enlisted traveling companions to assist in importing the fruits of his foreign explorations to minimize impediments such as customs inspection of his importations. Later as a post-doc with Pat Shea in California, Don invited me to his and Janet's home. This featured a tour of his wine cellar, and its carefully nurtured collections from Chile, France, Eastern Europe, South Africa, Spain, and of course Australia and California. When Don visited me in Minnesota, we shared a 16-yr old bottle from Coonawarra. I poured, he exclaimed – "this is good!"

I learned much from Don ... BC, wine, & Life.

Concurrent Workshops – Session V

Insects and Disease Issues Associated with Oaks in California

co-Moderators
Dr. David Rizzo, University of California, Davis
Dr. Patrick Shea, Pacific Southwest Research Station and University of California, Berkeley

Insect of Oaks

Vernard Lewis, University of California, Berkeley, presented information on insects of oaks that were the subject of his Ph.D. dissertation. Oaks in the genus *Quercus* and family Fagaceae are a valued resource for many habitats in California. Oak woodlands comprised about 20 million acres in the state and are an essential habitat for over 5000 species of insects. Most insect/oak associations are beneficial or benign. Only 15 species cause measurable damage to trees. Among these are the *California* oak moth, *Phryganidia californica* (Lepidoptera:Dioptidae); the filbert weevil, *Curculio occidenttis* (Coleoptera: Curculionidae); and the filbert worm, *Cydia latierreana* (Lepidoptera:Tortricidae). Vernard presented data from field trees that correlated oakworm numbers in the crown with frass collected in ground level stations. For the acorn weevil data from 36 trees revealed a significant correlation for damaged acorns and larvae present inside. Sadly, there are few researchers that study life history, population biology, or chemical ecology for many oak insects. For advances to occur in pest management and conservation of biodiversity among oaks, money and trained talent are badly needed.

Brice McPherson, University of California, Berkeley described his recent research on the association of insects and Sudden Oak Death. Colonization of bleeding cankers on coast live oaks by ambrosia and bark beetles (Coleoptera: Scolytidae) is a notable symptom of this disease syndrome. Saprotrophic beetles, ubiquitous in forests, may affect tree diseases in multiple ways by: 1. weakening infect trees; 2. predisposing trees to infection; 3. introducing disease propagules from their source to new areas; 4. accelerating disease progression; 5. defeating plant defenses. Structural failure of bleeding trees is often physically associated with abundant beetle tunnels. Ambrosia beetles (principally *Monarthrum* spp.) are observed to tunnel into sound, undecayed sapwood, avoiding decayed material. Brice and colleagues speculate that the tunnels of ambrosia beetles, extending 10 cm and greater into the sapwood of infected trees, introduce decay fungi and weaken trees by removing significant amounts of structural wood.

Ted Swiecki, Phytosphere Research, reported on The California Oak Disease and Arthropod (CODA) host index database. CODA is a comprehensive compilation of information on agents that colonize or feed on oaks in California. Agents in the database include plant-feeding insects and mites, nematodes, microorganisms, viruses, and abiotic disease agents. CODA contains summarized information on hosts, agents, information resources, and the details of other host-agent interaction. CODA contains information on 16 host *Quercus* species, including both native and introduced species, and over 1700 agents (arthropods, microorganisms, and abiotic factors), which yield more than 26 unique host-agent interactions. All host-agent interactions reported in CODA are linked to the source of the records, including both literature citations and unpublished identifications. Originally created as a stand-along, distributed database, CODA has been converted, with support from USFS Region 5, to a web-based application that is searchable online (http://phytosphere.com/coda/). Searches by host and symptom can be used to identify likely causal agents from given symptoms. Many of the more common agents and symptoms associated with them can be viewed directly through links to images are served from the CalPhotos (http://elib.cs.berkeley.edu/photos/) and Forestryimages.org image databases.

Diseases of Oaks

Dave Rizzo, UC Davis, gave an update on Sudden Oak Death. One of the most important occurrences in the progress of this diseases during was the shipment of 1000s of camellias infected with *Phytophthora ramorum* from a southern California nursery in spring 2004. Infected plants have now been detected in nurseries in 21 states and one Canadian Province (British Columbia). This has triggered increased surveys of nurseries and forests throughout the United States. It is also clear that the European A1 mating type of *P. ramorum* has been found in nurseries in Oregon, Washington and British Columbia. This has led to increased concerns of the possibility of sexual reproduction and recombination between the European and North American populations of *P. ramorum*. It was reported last year that high rainfall levels in April 2003 led to very high levels of sporangia production in California forests. The consequences of this increased sporulation were seen in 2004. Increased mortality of tanoak and higher infection levels on coast live oak were noted in many locations. Although the coarse scale geographic distribution of *P. ramorum* did not change extensively, many previously uninfected forests were exposed to the pathogen. This was particularly true in the Big Sur area, northern Sonoma county and the area around Redway in Humboldt County. Everett Hansen briefly reported on the progress of the *P. ramorum* eradication project in southern Oregon. Although the pathogen has been found in several new locations near Brookings, it is clear that the project has served to slow the spread of the disease across the landscape.

Matteo Garbelotto, UC Berkeley, reported on the occurrence of oak mortality associated with infection by *Phytophthora cinnamomi* and drought in southern California. The main tree that has been affected was coast live oak (*Quercus agrifolia*). Bleeding caused by *P. cinnamomi* infection was correlated with twig flagging caused by the oak twig girdler. Infected trees were all in the proximity to avocado orchards. Avocados are well known hosts for *P. cinnamomi* and most likely served as an initial source of inoculum. Spatially, most *P. cinnamomi* infected oaks were found on mid-slope areas. Oaks along lakes or rivers had no signs of *P. cinnamomi*, presumably because they were under less moisture stress. Oaks further up slopes also had some *P. cinnamomi* infection, but suffered primarily from drought alone. Engelmann oak (*Q. engelmannii*) was rarely observed to be associated with *P. cinnamomi*. In greenhouse inoculation studies, Engelmann oak was much less susceptible to *P. cinnamomi* than was coast live oak.

Disease, Insect, and Management Issues Associated with the Pinyon-Juniper Type in the West

Brytten Steed, USDA Forest Service, Ogden, UT
William Jacobi, Colorado State University, Fort Collins, CO
Co-Moderators

This workshop was conducted as a panel of six short presentations and open discussion. Presentations were organized under three themes: mortality assessment, specific mortality agents, and management strategies and concerns. Results of recent mortality assessment efforts across the West were addressed by Eric L. Smith, USDA FS Forest Health Technology Enterprise Team (FHTET) in Fort Collins, Colorado and by John D. Shaw, USDA FS, Rocky Mountain Research (RMRS)-Forest Inventory and Analyses (FIA) in Ogden, Utah. Specific information on the biology and effects of particular insect and disease agents were provided by Steve Seybold (USDA FS PSW; pinyon ips), Holly Kerns, and Bill Jacobi (Colorado State University; root disease and dwarf mistletoe, respectively). Discussion of management activities and concerns were highlighted by Tom Eager (USDA FS FHP, Gunnison, CO) with comments provided by a number of the workshop participants. A summary of the presentation and related discussion are provided for each of the speaker topics. Approximately 20 people participated in the workshop with an equal mix of entomology and pathology specialists providing presentation and discussion input.

2003 Westwide Pinyon Pine Mortality Assessment
Eric L. Smith, USDA FS FHTET

In response to widespread mortality of pinyon pines in the West, Forest Health Protection staffs in four Forest Service Regions and the Forest Health Technology Enterprise Team organized two inventory survey projects during the 2003. The first effort was a Forest Health Monitoring (FHM)-sponsored ground survey, the second a special aerial detection survey designed to fly areas of pinyon not usually surveyed. This aerial detection survey delineated 3,850,000 acres containing dead pinyon. Mortality levels within these flight areas ranged from 1 to >30 dead pinyon per acre.

FHM ground surveys were conducted in Arizona, California, Colorado, and New Mexico. Survey design varied somewhat by state, but generally consisted of a cluster of three fixed radius plots to collect stand and regeneration data, and a set of transects to augment information on mortality levels. Plots were also generally located in areas of high mortality and local concern. In Utah, ground data were extracted from the 2003 Forest Inventory and Analysis (FIA) survey. FIA plot design consists of four fixed radius plots without additional mortality transect tallies. However, plot locations are random within a grid pattern so do not carry a location bias.

Table 1. Basic, preliminary results of the ground survey

STATE	ACRES REPRESENTED	# OF PLOTS	AVE. # PINYON/AC	PINYON MORTALITY
Arizona (incomplete)	905,335	123	8	29%
California	989,104	75	89	14%
Colorado	738,527	67	102	27%
New Mexico	7,818,000	34	153	15%
Utah (from FIA)	9,770,225	180	102	2%

Plots showed a wide range of mortality levels. Mortality was generally spread uniformly across tree size classes and was not strongly related to plot basal area. The small regeneration plots showed a wide range of regeneration conditions. Though a substantial proportion of the high mortality plots had high levels of pinyon regeneration, it is unknown how many of these small trees will survive.

Detecting Drought-Related Mortality Using FIA Annual Inventory Data
John D. Shaw, USDA FS FIA

The mission of the Forest Inventory and Analysis (FIA) program is to improve the understanding and management of our Nation's forests by maintaining a comprehensive inventory of the status and trends of the country's diverse forest ecosystems. The Interior West FIA (IWFIA) program is responsible for 8 western states - AZ, CO, ID, MT, NM, NV, UT, and WY. Nearly 120 variables are measured or observed: 63 are collected only once per location and 40 to 56 are collected on each tree and/or subplot on every visit. In the past, a periodic inventory cycle was used and all plots in a state were measured every 10 years. Baseline data are available for all 8 states. We currently use an annual inventory system and visit 1/10 of the plots in a state each year. Annual inventory has been initiated in most of the states in the IWFIA area.

Information on pinyon mortality from FIA plots serves as a good test of the FIA data, partly due to the large number of plots in the pinyon-juniper (PJ) forest type. Recent high levels of pinyon tree mortality due drought, insects, and diseases have inspired a number of efforts to assess changes in the pinyon stands. This mortality event was an ideal test of the FIA plot system: was our data was able to detect the widespread and patchy pinyon mortality, and could the periodic inventory system detect the relatively rapid event.

Results for pinyon mortality in Utah and Arizona suggest that the FIA data is able to detect the trend and magnitude of short-term change even if that change is at a relatively low level and has a moderate resolution to show change at a county or ecoregion level (figure not shown). Actual results of change detection using FIA annual inventory will depend on the number and distribution of conditions (i.e., forest type) of interest, the distribution of the plots, and the timeframe.

About dwarf mistletoe

Arceuthobium divarcatum is the only species of dwarf mistletoe on pinyon trees in the United States. This moderately sized (~8cm), olive green to dark brown parasitic plant occurs only on pinyon trees but will attack all pinyon species within its elevational range of 1200-3000 meters. The witches' brooms are small and not very obvious. Information on mortality rates or incidence values is not available.

About black stain root disease in the pinyon-juniper woodlands of southwestern Colorado

Black stain root disease (BSRD) is caused by the native fungal pathogen *Leptographium wageneri* var. *wageneri*, first identified in Colorado at Mesa Verde National Park in 1942. Local spread of this pathogen is through root grafts or contacts, but insects may be long distance vectors. This fungus affects the tree by preventing translocation of water and nutrients. Identification of BSRD should be done on green trees since other fungi cover up signs of this pathogen after the tree has been dead six months. Results from field research conducted by Sam Harrison, Holly Kearns, and myself are included in this discussion of the effects of BSRD.

In 1998 we conducted a pinyon health survey on 50, half-mile transects at two sites near Durango, Colorado. We recorded information on tree mortality, mortality agents, site conditions (slope, aspect, cover type), and tree characteristics (diameter, height, crown radius, damage). Results indicated that 50% of the transects had dead trees with 5.8% of all trees as dead or dying. Approximately 3.3% of trees had BSRD, 0.08% had ips attacks, and 0.05% had both BSRD and ips attacks. When transect intervals with and without BSRD were compared, significant differences were found in stand average diameter, basal area, stems per acre, and oak and forb percent-cover, but not in slope.

Trapping for possible insect vectors of the black stain pathogen were conducted at four sites using pitfall and hanging traps. Scolytid beetles trapped at the BSRD centers included several stump/root feeders (*Dendroctonus valens, Gnathotrichus denticulatus*, *Hylurgops reticulatus, Hylurgops porosus, Hylastes gracilis, Hylastes fulgidus, Orthotomicus caelatus, Xyleborus intrusus*) as well as the twig beetle *Pityophthorus confertus*, and stem/branch beetles *Ips confusus* (pinyon ips) and *Ips latidens*.

The Effects of Black Stain Root Disease on Pinyon-Juniper Woodlands

Holly Kerns, Colorado State University

A mortality impact study was conducted using transects and plots to examine the effects of black stain root disease (BSRD; *Leptographium wageneri* var. *wageneri*) in pinyon-juniper (PJ) woodlands. Results found that mortality centers ranged in size from 0.07 to 0.63 ha and were expanding outward at about 1.1 meter/year. Three-quarters of the stems in these centers either dead or dying (25% healthy/green, 7% chlorotic, 46% snags, 21% logs). Of the dead/declining pinyon approximately 91% had BSRD and *Ips* sp., 8.5% had BSRD but no *Ips* sp., and 0.5% had *Ips* sp. but no BSRD. Shrub composition and percent cover, as well as pinyon seedling density were not affected by BSRD. However, herbaceous cover was significantly higher in the centers. Viable pathogen was isolated regularly from 5-8 year old pinyon and once from a sound root dead 16 years.

Management considerations for STRD include recognition that many areas do not have the disease (only 3% incidence of BSRD on the landscape). In those areas with disease, 25% of the pinyon trees as well as the regeneration do not appear to be affected. Stands with high tree density tend to have more BSRD mortality but thinning may do little to mitigate the disease, at least in the short term. Trenching around affected trees (3-4 trees past dying trees) may mitigate spread of the infection center. Not enough is known about insect vectors of the pathogen to recommend a management strategy. However, removal of declining trees may mitigate *Ips* reproduction. Planting of non-host species such as junipers, ponderosa pine, or will also lessen the impact of the disease.

Isolation of Aggregation Pheromones from Male Pinyon Ips, *Ips confusus*
Steve Seybold, Pacific Southwest Research Station

The pinyon ips, *Ips confusus* (LeConte), is a pine bark beetle that is the main insect mortality agent of two species of pinyon pines (*Pinus monophylla* and *P. edulis*) at intermediate elevations in the desert southwest of the USA and Mexico. Land managers in these areas are interested in monitoring the flight of and reducing tree mortality caused by *I. confusus*. The attractant aggregation pheromone of *I. confusus* consists of the three monoterpene alcohols, ipsenol, ipsdienol, and *cis*-verbenol. These pheromone components were isolated, identified, and reported in the 1970's by M.C. Birch, R.M. Silverstein, and colleagues. Using insect and plant material collected from the Pinenut Mountains in Nevada, we have used GC-MS and GC-EAD to analyze Porapak-Q-trapped volatiles from male- and female-infested *Pinus monophylla* logs and from logs of *P. monophylla* and the non-host, *Juniperus osteospermae*. Our analyses confirmed the earlier work and revealed that males produced (4*S*)-(–)-ipsenol and (4*S*)-(+)-ipsdienol. *cis*- and *trans*-Verbenol and verbenone were present not only in male samples, but also in female and host alone samples. Of the two enantiomers of ipsenol, only (−)-ipsenol was EAD-active on female and male antennae, whereas both enantiomers of ipsdienol were EAD-active. Field studies of the flight behavior of *I. confusus* with the commercially available enantiomers of ipsdienol in Nevada, Utah, and Colorado revealed a distinct preference by both sexes for (+)-ipsdienol in Nevada. The trap catches from Utah and Colorado have yet to be analyzed. The spiroacetal conophthorin, which interrupts aggregation in other *Ips* spp., did not interrupt the flight behavior of *I. confusus*.

Management Activities and Concerns in the Pinyon-Juniper Type
Tom Eager, USDA FS FHP

The assessment of pinyon-juniper (PJ) mortality across the West was a great effort on behalf of many people. We should note that 'PJ' and its mortality is not the same across the West. Many different stand conditions and types of pests exist so we shouldn't lump all PJ types together in our discussions.

Preventative insecticidal spray is a common management strategy used to prevent mortality of high-value pinyon due to the pinyon ips. The chemical carbaryl is the most common spray used and appears to be quite effective. However, pinyon trees are hard to spray with all their branches. There is also a question as to how many times the tree needs to be sprayed. In Colorado trees are sprayed twice. Some suggest spraying three times, but in Arizona, Utah, and Nevada they spray only once. The additional sprayings as well as the high amount needed to cover a branchy pinyon all add to the final cost of treatment. Last year there was concern that carbaryl may be removed from the market, so several people began testing the pyrethroid 'bifenthrin'. Results are not yet analyzed from this effort.

Fuels treatments in PJ are also being done. We use to say the PJ didn't burn even when range managers were trying to kill it off. Most of the thinning is being done with a machine that grinds up the trees with green and some dead trees being removed. Attempts to reduce fire hazard by pruning the first 4-5 feet of a tree has backfired due to attraction of pinyon ips. Discussion, however, noted that the problem of drawing pinyon ips into a treatment area may vary by season or by region.

Discussion Notes

Discussion about BSRD in pinyon noted that the Four-corners area is heavily infected. However, as Fred Baker stated, it is probably more pervasive than people realize and he has even found it in southern Idaho. When visiting with range managers he's been told that the lack of pinyon in some areas is due to a lack of specific mycorrhizae but upon closer inspection Fred has found BSRD. Fred also asked whether BSRD incidence has been related to disturbance such as 'chaining' of PJ by range groups. John Popp has done some viewing of aerial photos to compare mortality to gas and oil activity and felt that there probably is a relationship. Jim Hoffman has also seen two root disease centers that appeared to be related to Christmas tree cutting disturbance.

Interestingly, root diseases in other systems seem to prefer the moist cool soils, yet in Holly's studies the disease expansion rates did not appear to be related to any soil characteristics. Holly also noted that although isolations of BSRD were made from a fairly intact 16 year old snag root, most dead pinyons in her study decayed and fell apart too quickly (with help from termites and carpenter ants) to transfer the disease for very long after death. Others noted that transmission of the disease likely needs the classic root-to-root contact. If insects vector the disease over greater distances it still appears that they likely do not move very far.

Several pathologists highly recommended that during assessments of activity by pinyon ips and other insects that BSRD not be overlooked. It may, in fact, be important in the maintenance and movement of pinyon ips, at least at endemic levels. However, Bill Jacobi noted that ips may be working at a different scale than the BSRD.

Bark Beetle Prevention Programs: New Approaches and Progress

Ron Billings, Texas Forest Service, Moderator

An unstructured, informal workshop was held to discuss bark beetle prevention programs, with emphasis on those federally funded programs recently initiated under the President's Healthy Forest Initiative. Individual summaries of state programs were provided by Ron Billings (Texas), John Nowak (southern states), Dave Overhulser (Oregon), Ladd Livingston (Idaho), Karen Ripley via e-mail (Washington), and Mike Wagner (Arizona). Andy Eglitis and Ken Gibson discussed prevention programs on federal lands in eastern Oregon and in western Montana and Idaho, respectively. In turn, Lorraine Mclaughlin and Peter Hall described the current mountain pine beetle outbreak in British Columbia that was taking precedence over prevention. Cost shares are commonly being offered as incentives to thin susceptible conifer stands for bark beetle prevention on private forest lands in the southern and western U.S. These programs are hampered by low timber prices and lack of markets for small diameter trees. Costs per acre for thinning treatments are high in those areas where no markets for trees are available.

Current Research on Sucking Insects in North America

Andrew B. Lawson, Plant Science Department, California State University, Fresno Moderator

Attendees: Janie Booth, Cameron Currie, Jesus J. Guerra, Bruce Hostetler, Michele Eatough Jones, Andrew Lawson, Helen Maffei, Tim Paine, Scott Salom, John Wenz, Bill Woodruff.

Matsucoccus: Cryptic Suckers
Janie Booth, Entomology Department, University of California, Davis

In North America, *Matsucoccus* (Coccoidea: Margarodidae) is a poorly understood genus of scale insects. Approximately 19 species are present on the continent and at least two of these species are often important pests of their *Pinus* hosts. However, *Matsucoccus* species are rarely identified to species and interspecific relationships remain unclear. A graduate research project was described that included the creation of a phylogenetic tree of the genus *Matsucoccus* based on morphological and genetic data. The D2 expansion region of the large subunit ribosomal DNA gene (28S) is the first gene sequence being examined. Some of the major challenges of the research project include obtaining live adult females for identification purposes as well as choosing and/or designing appropriate DNA primers.

Status of *Laricobius* Spp. (Coleoptera: Derodontidae) in Biological Control of the Hemlock Woolly Adelgid (Homoptera: Adelgidae)
Scott Salom, Dept. of Entomology, Virginia Tech University

Hemlock woolly adelgid (HWA), *Adelges tsugae* Annand (Homoptera: Adelgidae), an exotic pest that attacks and kills hemlock trees in the eastern United States, infests hemlock in close to

50% of its geographic range. It has the potential to spread throughout its entire range. Preservation of hemlock forests is important ecologically as they provide critical and unique habitats for many bird, mammal, amphibian, and fish species. Biological control with a complex of predators is considered the most promising action against HWA in the forest setting. One predator that is being evaluated as a biological control agent is *Laricobius nigrinus*, a Derodontid beetle found in western North America. Previous studies have demonstrated that *L. nigrinus* feed selectively on HWA and its lifecycle is synchronous with that of the pest. Other studies have focused on field evaluation and development of rearing procedures for this predator. Concurrent projects include competitive interactions among other biological control agents, impacts of insecticides on predator performance, and foreign exploration for other *Laricobius* sp. To date, we have released *L. nigrinus* in 5 States in the mid-Atlantic region of the USA. We are evaluating optimal release and recovery methods for this insect. Our goal is to determine its establishment, dispersal, and impact on HWA populations.

Biology, Monitoring and Control of the Asian Wooly Hackberry Aphid, *Shivaphis celti* Das, in California

Andrew B. Lawson, Dept. of Plant Science, California State University, Fresno

The Asian woolly hackberry aphid (*Shivaphis celti* Das) was introduced into California in the summer of 2002. The aphid has spread quickly on Chinese hackberry trees throughout the state, creating a honeydew nuisance and causing complaints in many urban settings. Populations of the aphid were monitored at three sites in Fresno, CA beginning in the spring of 2003. Monitoring methods included foliar counts of aphids as well as water sensitive cards hung in trees in an attempt to relate honeydew production to aphid populations. Populations at all three sites showed similar trends with numbers dropping in the hottest summer months and increasing into the early fall. Systemic treatments of imidacloprid in the spring of 2004 showed significant reductions in aphid populations compared to untreated controls in two of three study sites. Populations in the insecticide treatment study will be followed throughout the 2004 growing season.

Biological Control of the Spotted Gum Psyllid, *Eucalyptolyma maidenii*: A New Pest on Urban Eucalyptus Trees in Southern California

Tim Paine, Dept. of Entomology, University of California, Riverside (presenter)
Kent Daane, Div. of Insect Biology-ESPM, University of California, Berkeley (co-author)

The spotted gum psyllid (*Eucalyptolyma maidenii*) was first reported in Los Angeles County in August 2000 infesting lemon-scented gum (*Corymbia citriodora*) and spotted gum (*C. maculata*). The psyllid very quickly spread throughout Los Angeles and Orange Counties. The infestation is primarily in the southern part of the state where the two species of eucalypts are more common. A research program to determine the ecology of the psyllid and to establish a biological control program was initiated by Prof. Donald Dahlsten. With the recent tragic passing of Prof. Dahlsten, the program is continuing under our direction.

The infestations of the spotted gum psyllid produce unsightly white structures, or lerps, on the leaves of the gums, and dripping honeydew causes the sidewalks to become blackened and sticky. The lerps, constructed by the psyllids from excrement and wax, shelter the feeding

nymphs. In addition to the lerp-forming spotted gum psyllid, the lerps can also be infested by a commensal free-living psyllid, *Cryptoneossa triangula* (lemon gum psyllid).
Little else is known about the potential effects of the psyllids on the host trees in the United States. However, other species of introduced psyllids infesting eucalyptus in California have caused serious defoliation and death as populations have increased due to absence of natural enemies. Disney Resort and the city of Anaheim initiated a short-term management program using pesticides to attempt protection of recently planted trees on streets and at the Disneyland Resort in Orange County. This program included establishment of a monitoring program, and evaluation of the effectiveness of potential management techniques. Single applications of soil drench insecticides have not shown to be effective for more than a few months, and effectiveness is variable.

During the 2003-2004 period, Prof. Dahlsten expanded sampling to three southern California counties and tested monitoring methods for the spotted gum psyllid, using both a trap for adult psyllids and foliage sampling for immature stages. He found that spotted gum psyllid populations in this area generally have two high periods annually (late spring-early summer and fall). Most likely excessively lower and high temperatures reduce psyllid activity. Psyllid levels usually remain low during cool winter months and also dip during the hottest summer months. Managers at several plots carried out pesticide sprays or soil drench. At most the effects of these applications were temporary or minimal on the psyllid populations. Lemon gum psyllids generally closely follow the spotted gum psyllids in population trends. Specificity testing was completed on candidate species of parasitoids and one species was determined to be an effective agent that can be developed for rearing and release. Contacts have been made with Australian scientists to collect and ship the parasitoid to California.

Summary: Jesus J. Guerra-Santos,Departamento de Ciencias Agrícolas. Facultad de Estudios Superiores Cuautitlán,Universidad Nacional Autónoma de México presented an update on biological control of the redgum lerp psyllid in Mexico. Methods of rearing the parasitoid *Psyllaephagus bliteus* were described as well as monitoring of the psyllid and parasitoid populations.

Discussion during the workshop included questions of why we have seen such dramatic increases in exotic pest introductions in recent years, especially on eucalyptus. The contributions of Prof. Donald Dahlsten to the area of urban forest entomology and his psyllid work in particular were acknowledged.

Special Paper

WIFDWC Special Paper

Bill Jacobi, Moderator

Impact of Armillaria and Annosus Root Diseases on Stand Structure and Down Woody Material in a Central Oregon Mixed-conifer Forest.

Kristen L.N. Fields
USDA Forest Service, Forest Health Protection, Bend, Oregon

White and grand fir are both valuable components of the mixed-conifer stand structure managed for late-successional reserves in central Oregon. However, they are often short-lived species because of high susceptibility to root diseases, defoliating insects, bark beetles, and wildfire. This makes long term management objectives focused on sustaining late successional reserves difficult to achieve. This study focuses on the effects of root diseases caused by Heterobasidion annosum and Armillaria spp. on the stand and canopy structure and fuel loadings (coarse woody material) in high elevation late-successional reserves 10 years after a severe western spruce budworm outbreak.

The study occurred on the Sisters Ranger District, Deschutes National Forest located on the eastern slope of the Cascade Mountains. Field data were collected during the summer of 2001 on 25 quarter-ha plots with varying levels of root disease. All plots were located in white fir climax communities spanning in elevation from 975 to 1400 m. Past disturbances included salvage logging, fire suppression, and a western spruce budworm defoliation in the late 1980s.

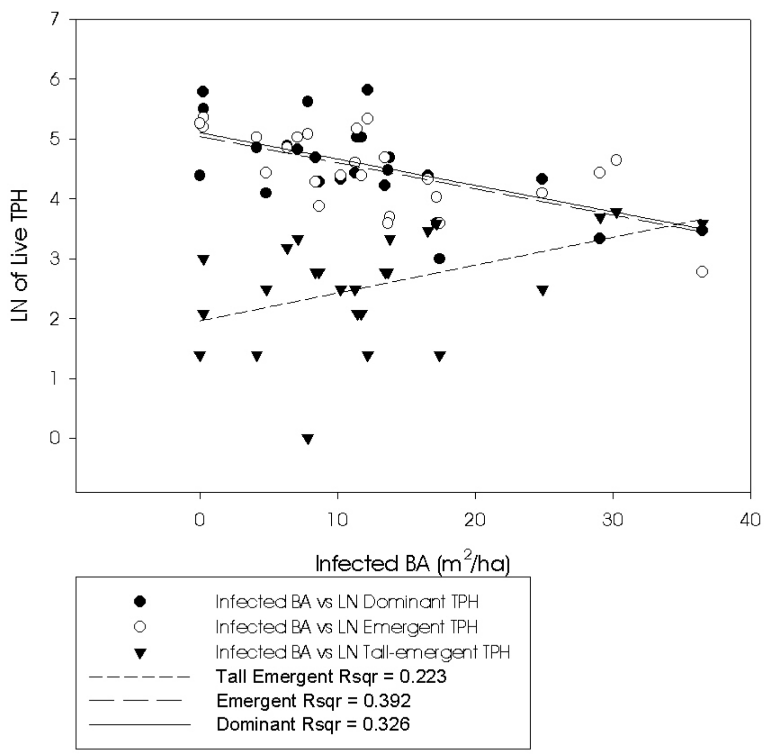
The level of root disease was measured by the infected basal area (m^2/ha). This was calculated by summing the basal area of each infected tree, where if a tree was infected with Armillaria or annosus the basal area of that tree was counted towards the plot "infected basal area". The size-class structure was divided into four diameter-size classes: tall-emergent (≥60 cm dbh), emergent (30-59.9 cm dbh), dominant (15-29.9 cm dbh), and tall-intermediate (5-14.9 cm dbh).

For most analyses multiple regression techniques were used to determine the effect of the amount of root disease on different stand attributes. A backward model selection technique was used to determine the best variable for each model with the understanding that the level of root disease may not be the primary variable causing differences in stand attributes.

It was hypothesized (H_A) that the mortality rates would increase with an increase in the level of root disease and that this would differ by diameter class and tree species. White fir and Douglas-fir both had significant increasing mortality levels with an increase in infected BA (adjusted-R^2 0.729 and 0.255, P<0.007 and 0.0001 respectively). However, ponderosa pine did not show any significant increase in mortality with any of the explanatory variables (P<0.117).

When looking at the amount of mortality by diameter class, excluding white fir, only the emergent diameter class (30-60 cm) had a significant increase in mortality with an increase in the amount root disease (adjusted-R^2 0.323 and $P<0.002$). The amount of mortality in white fir significantly increased with an increase in root disease for all diameter classes greater than 15 cm dbh.

When comparing the slopes of the natural log of trees/ha with in the dominant, emergent, and tall-emergent diameter classes, a different picture arose with an increase in infected BA. The dominant and emergent diameter classes decreased at the same rate with an increase in infected BA. However, the number of trees/ha (primarily Douglas-fir and ponderosa pine) increases in the tall-emergent class (>60 cm dbh) with an increasing infected BA. Indicating that there are more large trees (Douglas-fir and ponderosa pine) left on site where there is more root disease.



I hypothesized that with an increasing infected basal area that tree canopy cover would decrease and this would be for total canopy cover and the canopy cover within each of three layers, lower, middle, and upper. Surprisingly, infected BA had no significant relationship with total canopy cover or cover in the upper canopy layer.
The live BA and infected BA significantly predicted the amount of canopy cover for the middle canopy layer. As expected, the amount of canopy cover for the middle layer decreased with an associated increase in infected BA. The live trees/ha and infected BA predicted cover for the lower canopy layer, however, this relationship was inverse of that in the middle layer.

I hypothesized that the total fuel loads would increase with increasing infected basal areas and that this relationship would be different for the different fuel size classes.
The final model for the mton/ha of fuel only included infected BA ($P<0.001$, adjusted-R^2 0.677). With an increase in infected BA by 1 m^2/ha, there is an associated increase of 5.258 metric tons per hectare (95% CI 3.749 to 6.765) of fuel.

Some of the general observations were that Armillaria and annosus were diffuse throughout all of the stands. They were still aggressively killing trees 10 years after the western spruce budworm defoliation. Annosus and Armillaria were also the primary mortality agents in these mixed-conifer stands in a complex of defoliating insects, bark beetles, root disease, and drought. Some of the ecological implications were that this increase in root disease expression, combined with other agents, is playing a role similar to that of low intensity fire. In that it is decreasing the density of the late seral white fir species and retaining the larger Douglas-fir and ponderosa pine on the site through selective thinning. Differing from that of fire, root diseases are also putting these stands on a different successional trajectory with white fir in the understory. Root diseases are creating conditions unfavorable to promoting the establishment of the early seral ponderosa pine and western larch. It is also leaving white fir as the dominant and codominant species which may meet the short-term management objectives in late successional reserves. However, the persistence of these desired stand structures is unstable, as these sites will surely experience more drought, defoliation, and succumb to the root disease on the site.

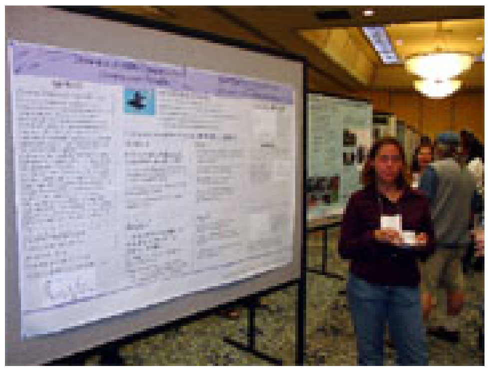
Poster Session


Andy Eglitis, Dennis Haugen, and Ladd Livingston


Sweet treats


Poster set up


John McLean


Poster in place

POSTER TITLES AND ABSTRACTS

Efficacy of Verbenone in Reducing Mountain Pine Beetle Attack in Lodgepole Pine

Robert Progar

Mountain pine beetle, *Dendroctonus ponderosae*, is the most common cause of mortality of mature lodgepole pine, *Pinus contorta* var. *latifolia*. In 2000-2003 the antiaggregative compound verbenone was applied annually to the same lodgepole pine stands in campgrounds and resort facilities at the Sawtooth National Recreation Area in central Idaho to assess its ability in deterring mountain pine beetle attack through the course of a multi-year outbreak. Verbenone was applied at the rate of forty 5 g pouches/acre releasing 25-35 mg/24h at 20 °C. Significantly fewer trees were attacked and killed in the verbenone plots during 2000 and 2001. However, of the plots containing verbenone, a higher percentage of large trees were attacked in the second year of treatment, suggesting that the efficacy of verbenone may diminish under increasing beetle pressure. In 2002 and 2003, there were nearly twice as many trees attacked and killed in the verbenone plots as in the untreated plots. It is hypothesized that the change in the performance of verbenone may be due to the ambient pheromone from the high number of attacked trees present during the beetle outbreak.

Chips and DIPS (“Drawing in Pine Scolytidae”): Effective Slash Management in the Wildland Urban Interface or a Recipe for Disaster?

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A relatively new method of treating green logging residue is to chip or shred the material on site. Anecdotal evidence suggests that bark beetles are attracted to host volatiles emanating from fresh chips. Thus, chipping may result in increased mortality of nearby residual trees. The purpose of this study is to determine the most effective means of minimizing impacts caused by bark beetles when treating slash by chipping. Specific objectives include determining the effects of slash management treatments (chipping versus lop-and-scatter) and season (spring versus late summer) on bark beetle activity. Three study sites (two in Arizona and one in California) were selected to include the following treatments: 1) chipping in spring, with random chip dispersal; 2) chipping in spring, with chips raked 2 m from the base of residual trees; 3) chipping in late summer, with random chip dispersal; 4) chipping in late summer, with chips raked 2 m from the base of residual trees; 5) spring lop-and-scatter; 6) late summer lop-and-scatter; and 7) control plots with no thinning. To date, late summer treatments were completed at all sites. Preliminary findings indicate that both *Dendroctonus* and *Ips* beetles are attracted to fresh ponderosa pine chips. Furthermore, initial large treatment differences in bark beetle attacks on residual trees were found with most attacks occurring in the chipping with no raking treatment. Based on the findings of this study, we will develop guidelines for land managers to mitigate unwanted tree mortality associated with thinning projects that include chipping.

Effects of Spotted Knapweed Invasion on Ground Beetle (Carabidae) Assemblages in Rocky Mountain Savannas

Allison K. Hansen and Diana L. Six
College of Forestry and Conservation, University of Montana, Missoula, MT

Spotted knapweed, an exotic plant that has invaded much of the western United States and Canada, alters environmental characteristics and severely reduces native plant diversity and abundance. In order to investigate impacts of spotted knapweed on savanna communities we initiated a study comparing ground beetle (carabid) diversity and abundance in invaded and un-invaded communities. Environmental variation is important in shaping carabid species assemblages, and in turn changes in abundance and distribution of particular species can indicate changes in environmental conditions. There was no significant difference in species richness and evenness between invaded and un-invaded sites; however, when species were delineated into trophic groups evenness was significantly higher in three of the four un-invaded sites. Indicator values (IndVal) were calculated for all species based on 8 partitions for all sites and species assemblages were identified per partition. Species assemblages clumped by environmental tolerances. Comparison of indicator species biologies to site and/or site groupings and results from non-metric multidimensional scaling (MDS) reveal that carabid assemblages are primarily shaped by soil texture, litter layer (litter, bare ground), and plant structure, and not by whether the site is invaded or not. Assemblages among invaded sites differ dramatically along a moisture gradient, however, they related to each other in preference to litter and vegetative structure.

The Effect of Tree Root Form on Susceptibility of Lodgepole Pine to Attack by Warren Root Collar Weevil

J.A. Robert and B.S. Lindgren

Young planted and naturally regenerated stands were surveyed for weevil and root form. While weevil incidence was not significantly different on planted versus naturally regenerated trees, weevil impact on height growth and stability was exacerbated in planted trees. This difference was attributed to differences in root form.

MtDNA Variation of Spruce Beetle, *Dendroctonus rufipennis*, throughout its North American Range: Distinctive Northern and Rocky Mt Clades, and a Potential Zone of Overlap in British Columbia.

Luana S. Maroja, Kimberly Wallin, Steven Bogdanowicz, Richard G. Harrison, Kenneth Raffa

The spruce beetle (*Dendroctonus rufipennis*) is an economically important phytophagous species, broadly distributed including populations in many formerly glaciated areas. We used mitochondrial DNA cytochrome oxidase I sequences to examine the geographical distribution of mtDNA lineages and to relate the current genetic structure with possible Pleistocene events. We evaluate whether *D. rufipennis* lineages are associated with major host tree species, *P. glauca* and *P. engelmanni* and calculate migration rates and divergence time between populations living in the range of each major host spruce tree species. MtDNA lineages were restricted to specific host tree species. Only in British Columbia, a hybrid zone for the spruce host trees, were two distinct mtDNA lineages sympatric. No migration was detected between populations living in the range of each host tree and the divergence time between these populations was 1.7 Myr. This divergence probably occurred due to the combined effect of several glaciation cycles. There was a strong isolation by distance across all populations. Populations from the east and west part of the Rocky Mountains are also isolated and diverged 8.6 thousand years ago.

Detecting Signals in Electroantennogram Data through Specific Waveform Amplification

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USDA Forest Service
Southern Research Station, Forest Insect Research

Electroantennogram (EAG) systems pair an electroantennal detector (EAD) with a gas chromatograph (GC). The detector is attached to the antenna of an insect and reads electrical potential across it. When a detectable molecule emerges from the GC and passes over the antenna, the detector records a dip in potential that has a characteristic shape, and a variable amplitude. A computer system is employed to record the molecules of a chemical compound emerging from the GC, and the output from the EAD simultaneously.

Currently, the state of the art in EAG analysis is to have an experienced operator look at the trace and decide where signal peaks are located. Though there have been some introductions of statistical methods for resolving peak height into signal and noise, the obvious drawback to simple analyses is that some noise peaks are larger than the signal. A promising method of resolving noisy traces is to average multiple EAG runs, but where the insect specimens are rare or difficult to prepare, this can
be impractical.

Here, we introduce a new method for separating the signals present in an EAG trace from the electrical background noise. It amplifies signals by recognizing their characteristic shape and wavelength while suppressing unstructured noise. It then applies parametric statistical methodology to identify the location of the signals.
We have found this method to be both powerful and highly discriminatory, even when applied to noisy traces where the signals would be difficult to discriminate by eye. This new method is removes operator bias as a factor, is superior to simple statistical peak discrimination, and simpler than multiple run averaging because only one run is required for analysis.

The Role of Wildland Fire and Subsequent Insect Attack on Ponderosa Pine Mortality – Year 2 Results of a Collaborative Research and Management Multi-Regional Investigation

Joel McMillin[1], Kurt Allen[2], John Anhold[1*], Ken Gibson[3*], Jose Negrón[4], Carolyn Hull Sieg[4] and Linda Wadleigh[5].

USDA Forest Service, [1]Region 3 Forest Health Protection, [2]Region 2 Forest Health Management, [3]Region 1 Forest Health Protection, [4]Rocky Mountain Research Station, [5]Region 3 Fire Management.

The fire year of 2000 provided an opportunity to quantify cumulative impacts of wildland fires and subsequent insect attack on ponderosa pine mortality over a large region. In 2001, we established plots in four National Forests: Black Hills in South Dakota, Custer in Montana, Arapaho-Roosevelt in Colorado and Coconino & Kaibab in Arizona. In each area, we sampled 1500+ trees in burned and unburned areas. For each tree, we measured height, dbh, pre-fire live crown ratio, percent crown scorch, percent crown consumption, percent scorched basal circumference, scorch height on the bole, and insect presence. In addition, we collected fourphloem samples from each of 200+ additional trees per fire to quantify the relationship between exterior signs of fire-caused damage and cambium damage. Tree mortality and insect presence will be monitored for a minimum of 5 years post burn; data from one-year and two-year post burn is presented. Our goal is to provide land managers with quantitatively based guidelines for assessing potential tree mortality following wildland burns.

Creating a Database of Condition and Distribution of Whitebark and Limber Pines

Blakey Lockman and Gregg DeNitto, USFS R1 Forest Health Protection,
Missoula, MT;Tony Courter, USFS, Forest Health Technology
Enterprise Team, Fort Collins, CO;
and Ronda Koski, Colorado State University, Fort Collins, CO.

There is a need for collating information collected on whitebark and limber pines. The goal of this project is to create a database of some basic plot parameters that can be queried. Maps will be created for a visual display of the distribution and general condition of these two species, and to highlight obvious data gaps. The database is not meant to be a repository for raw data.

The first level of the database has basic descriptors of plot/study results that can be queried and GIS-linked. These variables include location of plot, presence and percent infection of blister rust, density of host and non-host trees, presence of other injurious agents, mortality of whitebark and limber pines, and presence of regeneration of whitebark and limber pines. A second level is planned that will include a more detailed list of variables with the source information. These variables will be queriable as yes/no statements. An example of such a variable is "Ribes evaluated, yes/no?" For more detailed information, the user will then have to access the publication or get in touch with the contact person.

The results from this effort will be a completed interactive database, plus maps of the species distribution, the known locations of blister rust, the overall condition of the species, and a map that depicts the obvious gaps in data on the condition of these two species.

Project Leader: USFS FHP, Region One (Blakey Lockman and Gregg DeNitto)
Cooperators: Diana Tomback, Dept. of Biology, Univ. of Colorado, Denver; Robert Keane, Rocky Mountain Research Station, Fire Lab in Missoula, MT; Whitebark Pine Ecosystem Foundation; Forest Health Technology Enterprise Team, Fort Collins, CO; William Jacobi, Dept. of Bioagricultural Sciences and Pest Mgmt., Colorado State University.

Population Dynamics of Endemic Levels of Southern Pine Beetles

Sharon J. Martinson and Matthew P. Ayres

Southern pine beetles are destructive forest pests, causing massive tree mortality on broad spatial scales. Because beetle outbreaks (dense aggregations of beetles manifested by clumps of dead or dying trees) are devastating and easy to locate, the population ecology work done on this organism has focused on these large populations. The dynamics of endemic populations (low, nearly undetectable population levels) may be important in understanding why populations of these organisms exhibit such extreme fluctuations. When these beetles have low local abundances they are usually found associating with other bark beetles in weakened trees, often trees which have been recently struck by lightening. Under these conditions southern pine beetles experience both inter- and intraspecific competition for gallery space. Through asymmetric competition other beetle species may regulate southern pine beetle populations. The abundance of southern pine beetles in relation to other beetle species may influence the reproductive success of southern pine beetles. Timing of arrival of southern pine beetles compared to other competing beetles may also be consequential to beetle population dynamics. I propose research to study the dynamics of endemic populations of beetles in lightening struck trees, in order to determine the effects of competition on SPB populations.

Southern Pine Beetle Prevention and Restoration

John Nowak

The southern pine beetle (SPB) is the most destructive and costly insect pest of pines throughout the South, and recent damage caused by this insect exceeds all historical records. From 1999 - 2003, SPB caused unprecedented damage in Alabama, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. Well over one million acres were affected at an estimated economic cost of $1.5 billion. This includes private farms and forests, industry lands, state lands, national forests, and other federal lands. The potential exists for even greater losses in the future. Even though SPB populations declined in 2003, there are 89 million acres of pine in the South that are currently at moderate to high risk for SPB infestation. The Forest Service prepared a comprehensive strategy for addressing future infestations of the southern pine beetle. A major portion of this effort was to establish a Southern Pine Beetle Prevention and Restoration Program designed to help restore forests recently impacted by SPB and to prevent future infestations by improving tree health. Restoration activities return damaged areas to healthy forest conditions and create stands that are less susceptible to future SPB infestation. These activities include planting tree species best suited to the site, planting seedlings at appropriate densities, and encouraging the development of mixed species forests. Prevention activities seek to reduce SPB hazard while still providing desired forest values. These activities include prescribed burning and thinning (removal of excess trees) to increase the health of the remaining trees. Southern pine beetle prevention and restoration funding has totaled $13.6 million in fiscal years 2003 and 2004. The funding provided in 2003 and 2004 has helped start prevention and restoration programs on state, private, and federal lands; however, millions of acres remain in high hazard conditions or still require restoration from past SPB damage, stressing the need for continued efforts.

Monitoring White Pine Blister Rust Spread and Establishment in the Central Rocky Mountains

Kelly Sullivan, R2-FHP; Jeri Lyn Harris, R2-FHM; John Guyon, R4-FHP;
Jim Hoffman, R4-FHP; and Eric Smith, WO-FHTET.

Abstract: The most significant introduced disease organism of forests in the western United States is white pine blister rust (*Cronartium ribicola).* Within 50-years after introduction into Vancouver, British Columbia, Canada in 1910, the disease was widely distributed throughout the range of most of the white pine species. Of notable exception for blister rust disease incidence

was the high elevation white pines in the Great Basin and central Rocky Mountain ranges. However, in 1990 the disease was found infecting southwestern white pine in south-central New Mexico, at least 600-miles from the nearest known infections. Subsequent coordinated surveys have discovered presence of the disease in Nevada (1997) and Colorado (1998). Ongoing investigations suggest that white pine blister rust has the capacity to: 1) intensify in newly infected areas; 2) spread to previously unreported natural stands of bristlecone pine (Colorado, 2003); and 3) threaten uninfected white pine stands in Utah, Arizona, and Mexico.

Fertilization Decreases Red Pine Resistance to *Sphaeropsis sapinea*

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Sphaeropsis sapinea causes shoot blight and canker disease throughout the world on conifers predisposed by stress. Fertilization is often recommended to reduce stress, and presumably increase disease resistance. The study objectives were to examine the effects of fertilization on red pine (*Pinus resinosa*) resistance to *S. sapinea*, and on concentrations of constitutive and pathogen-induced secondary metabolites putatively involved in disease resistance. Wounded branch tips were inoculated with agar plugs colonized by the pathogen; noncolonized plugs were used for controls. Fertilization increased canker size ($P < 0.05$) and foliar nitrogen ($P < 0.01$), and decreased foliar C:N ratio ($P < 0.01$), constitutive lignin levels both locally and distally ($P < 0.05$), and total soluble phenolics distal to the inoculation ($P < 0.01$). At the infection court, inoculation significantly increased accumulation of total soluble phenolics ($P < 0.01$). Results show that fertilization decreases resistance of red pine to *S. sapinea*, and suggest that lignin and soluble phenolics might be involved in defense.

Aspen Decline in Northern Arizona

Mary Lou Fairweather, Kelly Barton, Mike Manthei, and Brian Howell.

For decades forest managers in the Southwest considered a regionwide decline in aspen communities the result of two factors: change in fire regimes since European settlement and heavy browsing by large ungulates. However, an accelerated decline of aspen communities has occurred across northern Arizona in the past five years, following two defoliation events (1998 and 1999) and several years of drought. An evaluation monitoring project was initiated in 2003, starting on the Coconino National Forest. Preliminary results show lower elevation sites with greater mortality and crown dieback. Although regeneration is occurring, ungulate browsing is severe on these sprouts.

Partnerships and Cooperation Combat Oak Wilt in Texas: The Texas Oak Wilt Suppression Project

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Texas Forest Service
College Station, TX 77840

The Texas Forest Service (TFS) initiated the Cooperative Texas Oak Wilt Suppression Project in 1988 to address a severe outbreak of oak wilt in native live oaks and red oaks in Central Texas. *Ceratocystis fagaceurum*, the fungus that causes oak wilt, is vectored principally by sap beetles of the family Nitidulidae. Objectives of the Suppression Project are to increase public awareness of the disease, detect and map the spatial distribution of mortality centers, provide technical assistance to affected landowners, and offer federal cost shares for trenching and infected red oak removal. Funding is provided by the USDA Forest Service, Forest Health Protection, Region 8, the Texas Forest Service, and private landowners impacted by the disease.

Accomplishments include establishment of a network of TFS foresters throughout Central Texas to address the problem, increased public awareness, including a partnership web page (www.texasoakwilt.org), periodic aerial sketch map surveys of 16 million acres, and a GIS mapping system of oak wilt centers. To halt the spread of 2,200 oak wilt centers, more than 3 million feet (568 miles) of trenches have been installed with federal cost shares. The $12 million of federal, state, city and private funds invested in the Suppression Project from 1988 – 2003 have yielded a benefit:cost ratio of 6:1 and saved Central Texas communities an estimated $72 million in tree removal, replanting, and fungicide injection costs. Other partners include the cities of Austin and Lakeway, Lady Bird Johnson Wildflower Center, Lower Colorado River Authority, National Biological Information Infrastructure, US Fish and Wildlife Service, neighborhood associations and private landowners in Central Texas, among others.

Biological Control of Ambermarked Birch Leafminer in Alaska

Chris J K MacQuarrie Department of Renewable Resources, University of Alberta, Edmonton, Alberta; David Langor Canadian Forest Service – Northern Forestry Centre, Edmonton, Alberta; Ed Holsten USDA Forest Service - Alaska Region, Anchorage, Alaska; John Spence Department of Renewable Resources, University of Alberta, Edmonton, Alberta; Daryl Williams Canadian Forest Service – Northern Forestry Centre, Edmonton, Alberta; Scott Digweed Canadian Forest Service – Northern Forestry Centre, Edmonton, Alberta

Effective establishment of a biological control program requires knowledge of the target insect prior to the introduction of the natural enemy. In 2003 we initiated studies to facilitate the introduction to Alaska of *Lathrolestes luteolator*, a parasitoid wasp, to control *Profenusa thomsoni*, the ambermarked birch leafminer (ABLM). ABLM is native to Europe and can be a serious pest of urban birch trees. Developing larvae feed inside leaves, resulting in blotch shaped mines on the upper leaf surface. In sufficient numbers whole trees can be affected; causing a loss of aesthetic value to homeowners and making trees susceptible to potentially fatal secondary infestations. ABLM currently causes significant damage to birch in Anchorage, Alaska and on Eielson Air Force base, near Fairbanks. In 2003 we established the range and phenology of ABLM in Anchorage and rural Alaska, identified sources of mortality and surveyed for the presence of other birch leafmining species. *Lathrolestes luteolator*-parasitized ABLM larvae were collected near Ft. Smith, Northwest Territories and overwintered as pupae in Edmonton, Alberta. These pupae will be shipped to Anchorage in spring 2004 where emerging *L. luteolator* will be used in caged and open releases.

Suture Zones, Ancient Mosaics, and Pest Endemism: Do Extant Distributions Reflect Ancient Phylogeographic Relationships and Landscape Genetic Structure?

G. I. McDonald, N. B. Klopfenstein, M.-S. Kim, P. J. Zambino, and B. A. Richardson. USDA Forest Service, Rocky Mountain Research Station, Moscow, ID 83843

Discontinuous geographic distributions of various native pests on conifer hosts are well known. Among the best defined are distributions of dwarf mistletoes. Conventional wisdom suggests that this endemism is due to environmental limits of pests or to relatively small-scale geographic dynamics that operate according to the geographic mosaic theory of coevolution that involves selection and metapopulations. Landscape genetics, a relatively new discipline, suggests alternative hypotheses. This discipline integrates assessments from biogeography, molecular population genetics, phylogeography, and landscape ecology to analyze the patterns and processes of gene flow and local adaptation. Genetic discontinuities are detected and correlated with landscape and environmental barriers. Intraspecific genetic discontinuities that co-occur in unrelated taxa and are geographically congruent (suture zones) appear to delineate evolutionarily significant ancient genetic mosaics that have lasted millions of years. Such ancient mosaics could be highly relevant to the management of natural resources, especially regarding pest management. Landscape genetics relies on the analytical power of maternally inherited molecular markers to unravel the phylogeographical history encoded in individual genomes and often reveals important unexpected discontinuities. In this poster, we combine haplotype and other genetic data with mistletoe and host distributions to postulate that dwarf mistletoes and their hosts may represent co-migrating ancient genetic mosaics that have been maintained throughout repeated global climate disturbances. This approach is being developed to better understand coevolution of host/pest couplets in the conifer forests of North America.

Wood Decay Fungi of Beetle-Killed Spruce in South-Central Alaska

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Large numbers of beetle-killed trees present a serious fire hazard in south central Alaska's Kenai Peninsula. Determining the rate of decomposition of this material will provide accurate estimates of how long this fire hazard will continue. Such information is needed for stand management decisions. In this study, wood decay fungi were collected and identified from Lutz spruce in five beetle-killed stands, a stand inundated in the 1964 Alaska earthquake, and 3 stands strongly influenced by fire and other unknown mortality agents. This study is in conjunction with coarse woody debris analysis of the stands conducted by researchers at Oregon State University.

In September 2003, 64 dead Lutz spruce [*Picea X lutzii* (Little)] trees from nine sites were sampled for the presence of decay fungi. Trees were selected from decay classes 1 - 4 on a 5 class scale (1 - recently dead/no decay; 5 - extremely decayed, becoming part of forest soil). Trees were also classified as "logs" (already on the ground) or recently cut "snags" (felled by OSU researchers in summer, 2002). Each log or snag had been cut into four different sections as part of the OSU project. All fruiting bodies on the sampled trees were collected and identified in the field or the laboratory. Sapwood shavings were also collected from each section by drill for cultural studies and for direct PCR amplification and identification by DNA sequencing. Preliminary results on fruiting body identification are presented here.

- *Fomitopsis pinicola*, *Stereum sanguinulentum*, and *Trichaptum abietinum* were the dominant fungi associated with decay class 1 and 2 logs and snags and were especially prevalent in beetle-killed stands. *Pycnoporellus alboluteus* was also frequently associated with early decay.

- Decay class 3 and 4 logs and snags associated with non-beetle sites displayed a much wider variety of decay fungi, often with numerous different fruiting bodies per tree and section. Both white rotters and brown rotters were common. Species of the genera *Trametes*, *Antrodia*, and *Phellinus* were particularly frequent.

- Recently cut snags generally displayed fewer fruiting bodies than logs in contact with the ground, probably due to desiccation.

- Larger numbers of fruiting bodies were found on basal log segments than distal ones. *Fomitopsis pinicola* was especially common on stump remnants and the lower portions of the tree.

- Trees inundated by salt water and silt from the Alaskan earthquake displayed very few fruiting bodies, probably due to their high salt content and further desiccation from the sun. The bases of these trees are buried in 6 feet of anaerobic silt, which would also slow basal decay. Brown rot decay of the wood was observed in many of these samples, however, and fruiting bodies of *Fomitopsis pinicola* were seen on several trees that were not sampled.

- PCR amplification and DNA sequencing will be used to identify cultures made from selected trees and to identify fungi directly from sapwood without culturing. These results will be contrasted with the fruiting body data.

Effect of Season and Interval of Burn on a Ponderosa Pine Ecosystem

Walter G. Thies, Christine G. Niwa, Becky K. Kerns, and Douglas J. Westlind

This poster reports the status of a long-term study introduced at the plenary session of the joint meeting in 2001. Prescribed burning is being used as a management tool to reduce fuel loads and restore ecosystem function in western interior forests. Yet, effects of seasonality and burn interval on ponderosa pine ecosystems remain poorly understood. In 1996, a study to examine effect of seasonality of prescribed burn was established in ponderosa pine stands in the south end of the Blue Mountains in southeastern Oregon. Three treatments (no burn, fall 1997 burn, and spring 1998 burn) were assigned randomly to three experimental units in each of six stands. The study has now been expanded to include burn interval as a treatment. Each experimental burn unit was bisected and one subunit of each pair was randomly selected to be burned every 5 years, while the second subunit will be used to test a 15-year interval. The season of burn for each subunit will remain the same as in the established study. This has resulted in two additional treatments (burned fall 1997 and 2002, and burned spring 1998 and 2003), for a total of 5 treatments in each of six replicate stands. All burns were operational in size, conducted on time and within prescription. The study was installed to determine the impact of season of burn on incidence of black stain root disease and its potential insect vectors. The study was expanded as funds became available to include response of other ecosystem elements such as understory vegetation, lichens, woodpeckers, bark beetle caused tree mortality, mycorrhizae, soil productivity, fuel consumption, impacts on native and exotic understory vegetation and tree growth and an evaluation of first order fire effects. This is a well-established study platform with a significant amount of data already collected. We invite other scientists to join us for collaborative studies to further increase our understanding of the response of a ponderosa pine ecosystem to fire. Results from this study complex will provide managers knowledge to evaluate two of the most basic variables of wildland fuel management, season and interval of burn.

Arthropods Taken by Birds in Three Forest Types in Southeast Alaska

Mark Schultz (USFS, State and Private Forestry, Forest Health Protection, Juneau, AK) and
Toni DeSanto (USFS, Pacific Northwest Forest and Range Experiment Station, Juneau, AK)

Trapping was done on four sites for each forest type, second growth-35 year old western hemlock/Sitka spruce and red alder/western hemlock/Sitka spruce stands, and mature 300-400 year old western hemlock/Sitka spruce stands. Arthropods were trapped on the stems of trees (crawling) or in Malaise traps (flying) in young-growth conifer and mixed red alder-conifer forests and in mature coniferous forests. There were 34, 37, 1, 2, 4, and 1 families of Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, and Neuroptera insect orders, respectively, that were trapped. There were three separate weeks of stem trapping for each site for a four month period in 2001 or 12 trap samples for each forest type. There were 30 Malaise trap samples for each of two consecutive 24 hour periods over a four month period in 2001, for each forest type. Spiders, springtails and insects made up the bulk of the food available to birds. Further analysis will determine what arthropods are most important during critical periods of nest building and rearing young. Total tree stem surface area is associated with arthropod biomass. Though large trees in mature coniferous forest stands might provide a greater biomass of food arthropods than smaller trees in young-growth coniferous forests, twice the bark area of young-growth conifer trees provide the same biomass. Mixed red alder-conifer young-growth forests have about the same food biomass as young-growth coniferous forests despite having 25% less stem surface area. The forest type did not significantly determine the amount of food provided. Mature coniferous forests provided more food biomass on stem surfaces but had about half of the surface area per acre as did young-growth conifer stands. Some birds might spend more time gleaning food from large tree stems and thus prefer the larger mature-forest trees. Hermit thrush was the only bird that had the least amount of food (on tree stems) available in mature coniferous forest of the nine insectivorous birds examined. Brown Creeper had the least amount of flying arthropod food available to it.

Protecting Individual Trees from Douglas-Fir Beetle Infestation with the Antiaggregation Pheromone, 3-Methylcyclohex-2-en-1-one (MCH)

Darrell W. Ross[1], Gary E. Daterman[2], Kenneth E. Gibson[3], Carol Randall[4], and Sandra Kegley[4]

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Previous studies have demonstrated the efficacy of the Douglas-fir beetle antiaggregation pheromone, 3-methylcyclohex-2-en-1-one (MCH), for protecting live Douglas-fir from infestation by the Douglas-fir beetle on areas up to several hundred acres in size. In some situations such as residential sites, recreation areas, and other high-value settings, it may be preferable to treat individual trees rather than areas. The objective of this study was to test the feasibility of protecting individual, high-valued Douglas-fir trees from infestation by the Douglas-fir beetle with MCH. This study included one MCH treatment and one control. The MCH treatment involved attaching 4 MCH bubble capsules equally spaced around the tree bole at a height of 4 m. Weak aggregation lures containing frontalin and seudenol releasing at 1.0 and 0.5 mg/day at 24°C, respectively, were attached to each tree to ensure beetle pressure on the study trees. The mean diameters of treated and control trees were 58.1 and 58.0 cm, respectively, and the difference was not statistically significant ($F = 0.01$; df = 1,5; $P = 0.905$). At the end of the season, all 36 control trees were infested and only 1 of the 35 MCH-treated trees remaining at the end of the study was infested. The Chi-square statistic indicated a highly significant treatment effect ($P < 0.0001$). The results of this study strongly suggest that placing 4 MCH releasers on an individual tree at a height of 4 m will consistently prevent infestation by the Douglas-fir beetle. Based on these results, individual tree treatments can be added to the existing recommendations for area-wide MCH applications to give resource managers, home owners, and pest control specialists an additional treatment to consider in developing plans to prevent Douglas-fir beetle infestation of high-valued trees.

Phoretic Mites from *Scolytus multistriatus* and *S. pygmaeus* (Coleoptera: Scolytidae) in Austria and their Possible Role in the Transmission of Dutch Elm Disease

John Moser, Heino Konrad, and Thomas Kirisits

The species assemblages and abundance of phoretic mites associated with the elm bark beetles *Scolytus multistriatus* and *S. pygmaeus* were studied in Austria. Stem sections of a tree infested by the two *Scolytus* species were collected in one locality in eastern Austria, and placed in a laboratory rearing cage. Beetles were collected after emergence from the logs and subsequently examined for the occurrence of phoretic mites and nematodes. A total of 3922 phoretic mites was recorded from both species, and the species spectrum for both species was similar. Nine mite species and two nematode species were found. The trophic roles of most mites are poorly known, but they may include fungivores, parasitoids of bark beetle broods, and/or mites and/or nematodes. Ascospores and conidia of *Ophiostoma novo-ulmi* were frequently observed on the bodies of *Tarsonemus crassus* and *Pseudotarsonemoides eccoptogasteris*, giving suspicion that these mite species may be involved in the transmission of Dutch elm disease.

Changes in Fire-killed Western Larch: Flathead National Forest, Montana

Marcus Jackson and Beverly M. Bulaon
USDA Forest Service, Forest Health Protection
Missoula, MT

Two years of data were collected to look at changes in western larch, *Larix occidentalis*, killed by the 2001 Moose Fire on the Flathead National Forest, Montana. Char, checks, decay, wood stain, and woodborer holes were measured on cross-sectional disks taken at stumps and every eight feet up tree boles. Additional data were measured prior to felling trees. Bolts were collected and emergence traps set to identify insect species that caused damage. One year after the fire, only minimal changes occurred in the wood, with less than 1% of the cubic volume lost to defects by woodborers. Two years after the fire, about 7% of the cubic volume was lost to defects caused by peripheral checks, sapwood decay, and wood borers. Nine wood boring insect species, representing four families, were collected from bolts and emergence traps. Woodpecker foraging increased from 63% of the trees one year after the fire, to 98% two years after the fire. Additional data will be collected 3, 5, 7, and 10 years post-fire.

Detecting Drought-related Mortality using FIA Annual Inventory Data

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The USDA Forest Service Forest Inventory and Analysis (FIA) program adopted an annual inventory system in order to obtain more timely information on forest resource status and trends than was possible using a periodic inventory system. Although data are collected on an annual basis, the number of plots measured in a given year is approximately 1/10 of the number

measured in a periodic inventory. This lower sampling intensity raised questions about our ability to detect and quantify patchy, rapid-onset changes such as insect and disease outbreaks using annual FIA data. Several years of drought in the Southwest have caused widespread mortality in the pinyon-juniper and ponderosa pine forest types. A complex of drought, insects, and disease is responsible for pinyon and ponderosa mortality rates approaching 100% in some areas, while other areas have experienced little or no mortality. Initiation of annual inventory preceded, or approximately coincided with, the beginning of the mortality event in Arizona and Utah. As of the end of the 2003 field season, three and four years of annual inventory data were available for Arizona and Utah, respectively. Preliminary analysis of the data appears to show spatial and temporal mortality patterns and trends. Perhaps the most interesting result is that trends have been detected at relatively low levels of mortality – for example, the statewide estimates of pinyon mortality in Utah increased from approximately 0.02% (basal area basis) in 2000 to nearly 5% in 2003. It appears that the annual system can capture status and trends of patchy, widespread, rapid-onset changes. Current investigations include the development of stratification options that may reduce variability in mortality estimates, and allow reporting of trends at geographic scales smaller than the state (e.g., counties or ecological regions). In addition, verification of plot-level mortality estimates being is being done using independent data sources, such as aerial imagery and adjunct ground inventory data.

Meteorological Aspects of White Pine Blister Rust in Colorado and Wyoming

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Cronartium ribicola is the causal agent for the exotic fungal disease known as white pine blister rust (WPBR). The production and germination of the various spore stages of *Cronartium ribicola* are affected by temperature, moisture, and time, and may also vary due to genetic and environmental conditioning. Favorable conditions of temperature and moisture must accompany an adequate amount of spores and susceptible hosts (*Ribes* species and pines).

The main objectives of this study are two-fold, the first is to determine if there are significant differences in meteorological conditions between study sites with various incidences of rust in Wyoming, and then use Wyoming data to build a risk model for white pine blister rust study sites in Wyoming and Colorado areas.

The meteorological data sources used in our analysis include RAWS (Remote Automated Weather Stations), HOBO stations, and Wyoming Department of Transportation (WYDOT) weather stations. There are a total 12 RAWS in Wyoming (5-12 years of data) and 9 RAWS in Colorado (10-15 years of data). Observations for RAWS include: one hour precipitation intervals, relative humidity, air temperature, wind speed and direction, and barometric pressure. Fourteen HOBO stations in Wyoming and 20 stations in Colorado provide two years data. HOBO observations include half hour intervals of relative humidity, air temperature and dewpoint. Four WYDOT stations in Wyoming provide 15 minute precipitation intervals, relative humidity, air temp, wind speed and direction, and dewpoint.

In order to identify "suitable infection periods" for white pine blister rust on ribes and pines, the data was restricted to the temperature, relative humidity, precipitation, and time factors believed to allow infection to occur. A suitable infection period was considered to be a 6 or 12 hour time period where all of the suitable meteorological conditions for rust occur. The restrictions chosen used were as follows:

- Time: May 1-September 30
- Relative Humidity: Greater than 90%
- Temperature: 32°- 75°F for May 1- September 30, or 70° - 82°F for May 1-July 15

Figures 1 and 2 show the amount of months with at least 5 and 10% of days suitable for infection (6 hours of ideal conditions) for Wyoming and Colorado RAWS sites.Colorado sites, in general, have more periods that are suitable for rust to occur than WY sites. All sites in Wyoming have rust present, and incidences vary. Based on our preliminary results we conclude Colorado has more days suitable for infection than Wyoming and therefore may be as, if not more, vulnerable to infection episodes.

Figures 3 and 4 compare the fall seasons (July-September) of Horse Creek/Elkhorn RAWS and EsterBrook RAWS. Late summer and early fall months may be more limiting to rust infection than spring, because they are drier overall. EsterBrook (Fig 4) has higher percentages of suitable infection periods than the Horse Creek/Elkhorn (Fig 3) site in the fall.

The duration of time rust has been present, incidence of rust, and number of infection periods varies between sites. Preliminary results show that different sites in WY have significantly different number of suitable infection periods. Based on the probable infection periods at Wyoming sites, it appears many areas of Colorado have conditions suitable for rust infection and that locations with differing amounts of rust in Wyoming have different amounts of probable infection periods.

EsterBrook and Horse Creek sites show a difference between the percent of the months suitable for infection in the fall. It may be necessary to isolate the fall months for study sites; we believe the fall months may be the limiting factor to rust infestation, because springs months generally have conditions for rust to occur.

Future work involves gathering more data points in Colorado and Wyoming, comparing more sites against one another and their respective HOBO stations, and attempting to identify meteorological conditions for infections to occur. We will combine these findings with other epidemiological factors and prepare a predictive model to predict the impact of white pine blister rust on currently uninfested areas.

Evaluating Traps and Attractants for Surveying Adult Woodborer Populations in Burned Areas of the Black Hills, South Dakota

Sheryl Costello
CSU-Department of Bioagricultural Science and Pest Management
Advisors: Bill Jacobi-CSU, BSPM and Jose Negron-Rocky Mountain Research Station

Woodborers are small to relatively large (5-70 mm long) insects and are attracted to trees that have been stressed or killed by agents such as the mountain pine beetle, *Dendroctonus ponderosae* Hopkins, drought, or fire. Woodborers are known to be an important food source for predators, including such environmentally sensitive species as the black-backed woodpecker. Additionally, several woodborers are considered of economic importance because tunnels created in the wood reduce the marketable value of wood. In order to extend our knowledge of woodborer chemical ecology in the Black Hills we initiated studies to develop trapping techniques to monitor woodborer populations. Monitoring techniques have not been developed for this area. The study will also provide information on the guild of species associated with fire in ponderosa pine ecosystems in the Black Hills. Two trap types and four different chemical attractants were selected. From May 30, 2003 through September 26, 2003 we collected 16 cerambycid species, 12 buprestid species and 5 siricid species. Results after one summer indicate that chemical attractants significantly attract more insects than control treatments. Preliminary results also indicate trap catch differences between chemical lures. Research in the summer of 2004 will again focus on chemical attractants and trap types, as well as examining densities of larvae under bark in different fire severities and different age fires.

Douglas-fir Beetle Reproduction in Burned and Unburned Trees in the First Year after Fire

Kjerstin R. Skov and Diana L. Six

Both fire and bark beetles are important agents of disturbance in the western United States. A major area of concern after fire is the potential for increased tree mortality due to bark beetles. Fire may weaken tree defenses and increase susceptibility to bark beetles. In particular, Douglas-fir beetle (DFB) populations have been observed to increase after fire. DFB may kill fire-weakened trees and emerging brood may move into green trees. Little research has investigated this interaction or identified trees that contribute to this population growth. Because the factors that suppress or contribute to beetle population expansion in fire-damaged and green trees after fire are not well understood, it is difficult at present to predict when management is indicated. We have begun a multi-year study to determine how fire affects Douglas-fir trees and how this in turn affects DFB reproduction and subsequent attack of green trees.

We measured 49 Douglas-fir trees (>20 cm dbh) from inside and outside the Kelly Creek fire on the Nez Perce NF. On burned trees we measured percent live crown scorch and percent bole scorch (on phloem from four quadrants). On 28 of these trees we measured water potential, net photosynthetic rate, phloem chemistry, and growth (not presented here). 26 trees were baited with DFB pheromones (Phero tech) and from these trees we removed 44 x 44 cm bark samples from two heights on the bole (1.4 and 4 m) in fall 2003. In each bark sample we counted new progeny and assessed factors that limited or contributed to reproductive success (crowding, resin defense, woodborer competition, evidence of natural enemies). We present these factors in relation to bark scorch, crown scorch, and to overall damage level (unburned control, and low, medium, and high fire damage).

Average length of parent galleries was less in trees with 50% bole scorch. Average length of larval galleries was greater in trees with 25% and 75% bole scorch. Lengths of parent galleries may decrease with increasing crown scorch, while larval galleries may increase. These opposing trends may be a result of crowding. Trees with medium overall fire damage had the lowest average parent and larval gallery lengths. Mean and total numbers of brood adults were highest in trees with high fire damage. The unburned control trees had higher reproduction than trees with low and medium fire damage, however this higher number of brood adults was from a single tree. More samples from the low fire damage category exhibited resin defense in beetle galleries. More trees from the high damage category had woodborer galleries competing with DFB.

Trees in the medium damage class had the least parent and larval galleries, produced no brood adults, and had more competition from woodborers. These results may be particularly related to 50% bole damage. Crown damage may be related to intraspecific competition; larval galleries may increase with increasing crown damage. DFB in trees with little or no fire damage must overcome more resin-based resistance from the trees. Trees with more fire damage may make a greater contribution to the next generation of DFB than trees with less fire damage. Our future work will include larger sample sizes, monitoring DFB attack and reproduction in the second and third years after fire, and will incorporate Douglas-fir chemical defenses and food quality of phloem.

Ontogenetic Resistance in *Pinus ponderosa* to *Rhyacionia neomexicana* (Lepidoptera: Tortricidae): Role of Anatomical Features

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Ontogenetic (or age) based change in tree resistance to insect herbivores is quite common. The *Rhyacionia* pine tip/shoot moths (Lepidoptera: Tortricidae) are a well-known example of insect herbivores that attack young but not mature pine trees. The southwestern pine tip moth *Rhyacionia neomexicana* is a native forest pest that primarily attacks young ponderosa pine, *Pinus ponderosa*, trees in the southwestern United States. The frequency of such tip moth attacks on ponderosa pine trees has been found to decline exponentially as the increase of tree age, which indicates a clear pattern of host tree age or size dependent. We compared the anatomical features of 10-year old saplings derived from rooted cuttings (stecklings) of sexually mature (19-33 years old) ponderosa pine trees (ontogenetically mature), and 10-year old saplings from seedlings (ontogenetically immature), and examined the infestation of tip moth on these saplings of different origins in order to investigate the mechanisms responsible for the restricted tip moth attacks of trees to a specific ontogenetic age in a field experiment study of paired design between 2000 and 2002. We found that ontogenetically mature saplings had greater one-year old needle length and toughness but significantly lower tip moth infestation over three consecutive years than ontogenetically immature saplings although these two groups of saplings were of similar size. We confirm that southwestern pine tip moth showed clear preference to attack ontogenetically immature trees, and conclude that differences in needle length and toughness likely explain this pattern.

Darkling Beetles (Coleoptera: Tenebrionidae), Ground Beetles (Coleoptera: Carabidae), and Ants (Hymenoptera: Formicidae) as Ecological Indicators for Ponderosa Pine Forest Conditions in Northern Arizona

Zhong Chen, Sky Stephens, Kevin Grady, and Michael R. Wagner
School of Forestry, Northern Arizona University, Flagstaff, AZ 86011-5018

As a part of an on-going “insects as ecological indicators for southwestern ponderosa pine forest” project in northern Arizona, this field experimental study has been conducted on 16 stands of 20-40 ha in size that represented one of the four forest conditions in Coconino National Forest: a) unmanaged (UN); b) thinned (TH); c) thinned followed by a broadcast burn (BCB); and d) wildfire burned (WF). We sampled darkling beetles, ground beetles, and ants by using pitfall traps on 10 permanent plots within each stand once a month between mid June and August in 2003 in order to test and verify the suitability of various measures of ground dwelling arthropods (particularly ground beetles and ants) as ecological indicators for ponderosa pine forest conditions. We found that 1) WF stands had the highest Shannon diversity (H) and species richness (S) for darkling beetles; whereas the TH and WF stands had greater H and S for ground beetles; 2) the species richness of ants tended to increase under moderate disturbance but decrease under severe disturbance; 3) WF stands had different species community assemblages of both darkling and ground beetles than other stands; 4) the relative abundance of ant opportunists was higher than all other functional groups of ants in UN, TH, and BCB stands; however, the abundance of ant generalists was highest in WF stands; and 5) four darkling and 3 ground beetle species, and 2 ant species are indicators for WF stands; 1 ant species and the opportunist functional group of ants are indicators for TH stands. There is no clear relationship between ground dwelling beetles and ants in terms of occurrence and abundance. Overall, the ground beetles are more sensitive to ponderosa pine forest conditions than both darkling beetles and ants, and thus highly suitable as ecological indicators.

Alternative Mixed Plantation Systems and Restoration Strategies for Conservation and Sustainable Production of Native Timber Species in Ghana

Sky Stephens[2], Mike Wagner[2], Paul Bosu[1], Joe Cobbinah[1]
[1] Forestry Research Institute of Ghana, [2] Northern Arizona University School of Forestry

Following persistent failure of native species plantations in Ghana during the early stages of forest plantation development efforts in the 1960’s and 1970’s attention focused on planting fast growing exotic species such as teak and Gmelina. Plantations of exotic trees provide wood for some industrial purposes, however, they fail to provide for the multitude of other non timber products. Some of the most valuable native species including Iroko, Afromosia, and the

mahoganies have not received adequate attention in plantation forestry. The explanation for the lack of interest in native plantations is 1) the high incidence of insects and disease pests that and 2) a failure to recognize the important ecological and cultural characteristics of species selected for plantations.
Three models of native mixed species plantation systems will be established and evaluated. They are “restoration”, “production” and “farm” plantation systems (Table 1). Each model plantation will include 5%, 10%, and 20% by density of *Milicia* (Iroko), *Pericopsis elata* (Afromosia) and the Meliaceae (mahoganies), to assess their impact on three insect guilds - *Phytolyma* galler, *Lamprosema* defoliator, *Hypsipyla* shoot borer, on Iroko, Afromosia, and the mahoganies (Figure 1), respectively. We will also assess ecological stability of each plantation system using ground beetle (Carabidae), ant (Formicidae), and butterfly (Papillionidae) diversity as bioindicators of forest health.

Bark Beetles and Associated Predators: Seasonal Abundance and Response to Commercial Lures in a Northern Arizona Ponderosa Pine Forest

Monica L. Gaylord[1], Thomas E. Kolb[1], Eric L. Smith[2],
Michael R. Wagner[1], and Kimberly F. Wallin[3]
[1]Northern Arizona University, Flagstaff, AZ, [2] USDA Forest Service,
Fort Collins, CO ,[3] Oregon State University, Corvallis, OR

Bark beetles (Coleoptera: Scolytidae) have caused landscape level mortality in many conifer forests across North America. Prior to the drought of 2002, there had historically been limited bark beetle activity in the ponderosa pine, *Pinus ponderosa* Douglas ex. Lawson, forests on the Colorado Plateau, however, by the fall of 2003 more than 29,000 hectares of ponderosa pine mortality on the Coconino National Forest was attributed to bark beetles. Due to the historical lack of outbreaks, very little is known about the seasonality and pheromone preference of the bark beetle complex in the Southwestern ponderosa pine forests. From January of 2002 through December of 2003 we monitored bark beetle flight and lure preference in a ponderosa pine forest 7 miles west of Flagstaff, Arizona using 5 different pheromone lures on 8-unit Lindgren funnel traps. For both years the majority of beetle flight occurred between May and October. During this time frame we witnessed multiple peaks for *Dendroctonus brevicomis, D. frontalis, D. valens,* and *Ips pini*. *Dendroctonus brevicomis, D. frontalis* and *D. adjunctus* were attracted in highest numbers to the lure targeted for *D. brevicomis.* The lure targeted for *I. pini* attracted the highest percentage of *I. pini* and *I. latidens* as well as the majority of the predators. The *D. valens* lure attracted the largest percentage of *D. valens*.

Tree Mortality and Insect Activity on Fire & Fire Surrogate Treatment Plots in South Florida, 2000 – 2003

John L. Foltz
University of Florida, Department of Entomology, Gainesville, FL

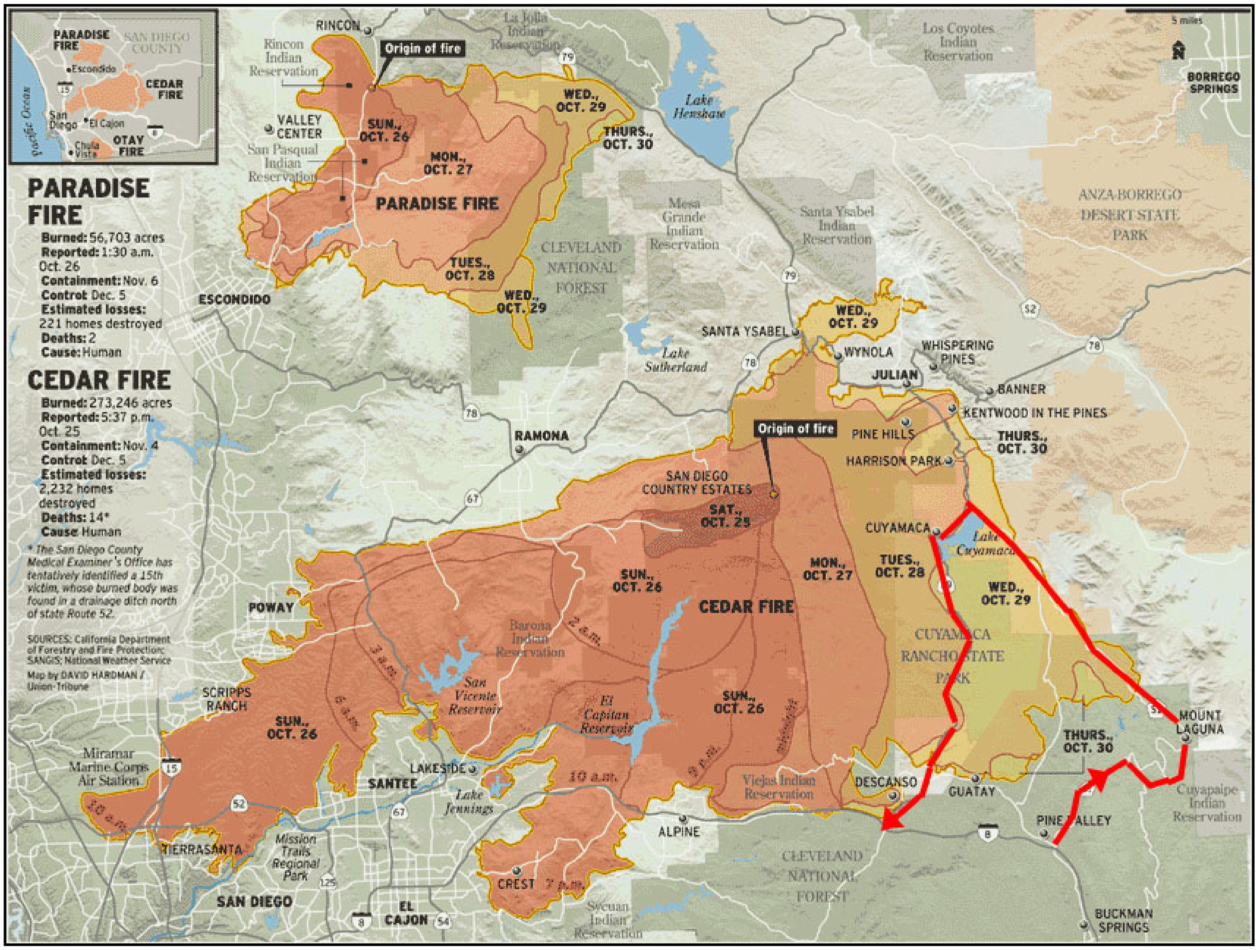
For the past 4 years I have been studying the tree mortality and insect activity on Fire & Fire Surrogate Treatment plots in the Myakka River State Park, Sarasota, Florida. The native forests are comprised of longleaf pine, *Pinus palustris*, and south Florida slash pine, *P. elliottii* var. *densa*. The study also includes a plantation of typical slash pine, *P. elliottii* var. *elliottii*, an exotic species in this region. Owing to the long exclusion of fire until about 20 years ago, these sites now have an understory dominated by saw palmetto and gallberry rather than forbs and grasses. The objective of the F&FS research is to assess methods for restoring the flatwoods forest to their pre-Columbian condition where forbs and grasses were the predominant component of the understory.

The 5 treatments applied to each of the 3 pine species (blocks) were: untreated control; a prescribed burn during the growing season; mechanical treatment with a roller drum chopper; a combination of burning and chopping; and a prescribed burn followed by mowing with a tractor-drawn mower. The original plan was to gather background data during 2000 and apply the treatments in 2001. On the longleaf area, however, an unplanned fire burned across all treatment units in July 2000 before any pretreatment data were collected. The other blocks were treated as planned with burns during the growing season of 2001 and mechanical treatments the following winter.

A total of 661 trees died over the 4 years, roughly 10% of the initial number of trees greater than 10 cm dbh. About two-thirds of this mortality was in the exotic slash pine; the remaining mortality was about equally divided between the 2 native pines. The extreme drought that started in 1998 and continued until summer 2001 was the leading cause of death. Second was fire, mostly from crown scorch and very little from stem char. Lightning strikes killed 33 trees and the winds of Tropical Storm Gabrielle broke or uprooted 24 trees. Although engraver beetles (*Ips* spp.) and cerambycids were present in all but a few of the dead trees, there was no indication that insects killed any of the trees.

WFIWC /WIFDWC Field Trip

The 2004 WFIWC/WIFDWC Field Trip took the meeting into the Laguna Mountain area of the Cleveland National Forest. This area has a long history of forest health activities centered on management of bark beetles, California flatheaded borer, and pathogens such as dwarf mistletoe and annosus root decay. Jeffrey pine is one of the dominant tree species here. This area also borders the October 2003 Cedar Fire, which consumed nearly 275,000 acres of forest and chaparral in the wildland-urban interface (see map below).



First Stop: Graffiti Rock near Pine Valley along the Sunrise Scenic Byway (Road S1) where Laura Merrill introduced Tom Gillette, District Ranger from the Descanso Ranger District of the Cleveland National Forest. Gillette discussed the history of the district, fire management issues, and resource and people management issues along the US-Mexican border.


Laura Merrill


Tom Gillette


Tom Gillette


Bill Woodruff and Don Owen


Tom Gillette


Tom Gillette


Brian Sullivan and Staffan Lindgren


Kerry Britton takes an important call—perhaps from the Washington Office??


Stop 1 Overlook


Native dodder


Stop 1 Overlook

Second Stop: Burnt Rancheria Campground where the group gathered in an amphitheater to hear a presentation by John Pronos on dwarf mistletoe and hazard tree management. Later, Diana Six and Tim Paine presented information on the life history of Jeffrey pine beetle. A few participants sampled the vanilla odors from the bark of Jeffrey pine. Some of the group noticed the acorn caching habit of semi-colonial woodpeckers in the larger trees in the campground.

John Pronos addresses the group in the Burnt Rancheria amphitheater

John Pronos addresses the group in the Burnt Rancheria amphitheater

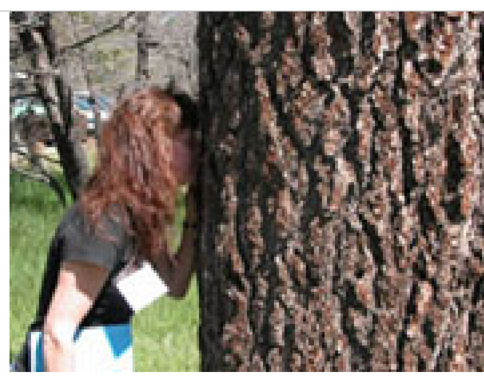
John Pronos

John Pronos

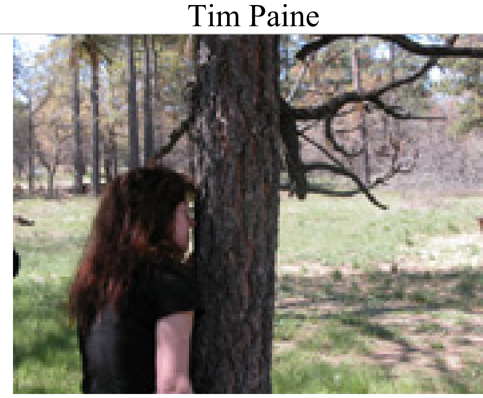
Tim Paine discusses Jeffrey pine beetle biology

Tim Paine

Judy Adams Dennis Haugen



Judy Adams and Eau d’ Jeffrey Pine



Judy Adams and Eau d’ Jeffrey Pine

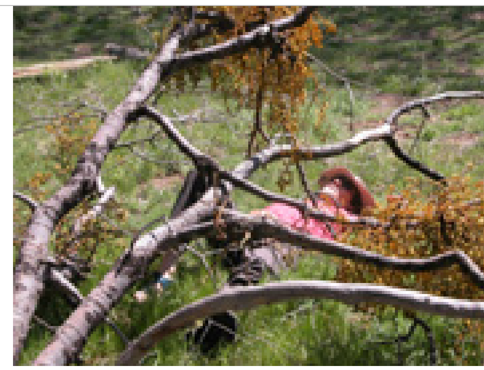

Diana Six with Jeffrey pine beetle galleries


Bill Jacobi has heard it all before

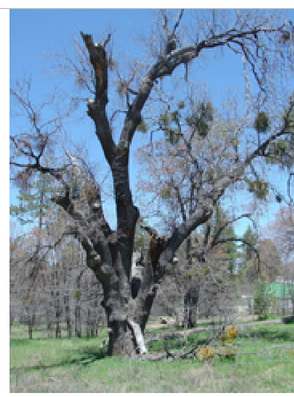

Tim Paine discusses Jeffrey pine beetle biology

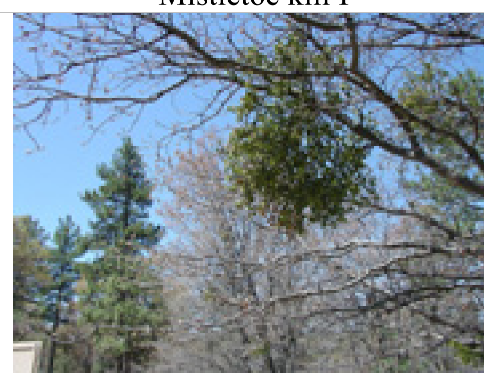

California flathead woodpecker


Scolytus ventralis


Mistletoe kill I

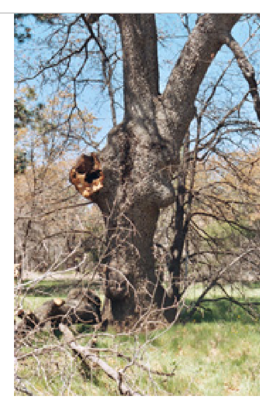

Mistletoe kill II


Hazard tree


Mistletoe


Woodpecker acorn caching


Acorn woodpecker tree



Lunch Stop:

 Lunch stop at desert overview	 New oak leaves	 Scenic view
	 Shrub flowers	

Third Stop: El Prado Campground where the group heard presentations by Dave Wood (California flatheaded borer, *Ips* spp., and risk rating systems), John Kliejunas (annosus root disease), and Bob Scharpf (pruning research on dwarf mistletoe).

Dave Wood lectures on woodborers and bark beetles at Laguna Mountain

Dave Wood lectures on woodborers and bark beetles at Laguna Mountain

Bruce Hostetler and Dave Wood

John Kliejunas tells the group about annosus root disease and stump treatment

John Kliejunas

John Kliejunas tells the group about annosus root disease and stump treatment

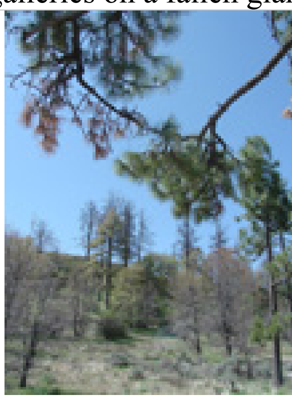
John Kliejunas

El Prado ranger cabin

Examining old Jeffrey pine beetle galleries on a fallen giant

Mary Ellen Dix, center

Bob Scharpf shared photos and recollections of his research with the district on pruning for dwarf mistletoe management



Pine mortality

Pandora moth larva

Contributed by Dave Wood: The interactions among bark beetles, annosus root disease and Jefftrey pine were discussed at this stop. John Kliejunas showed symptoms and fruiting structures of this important root disease that has attracted attention from forest pathologists since the 1950's in this part of California. Dave Wood pointed out the pitch tubes of the red turpentine beetle (RTB), *Dendroctonus valens*, which was observed colonizing the root collar and lower trunk of these "old-growth" trees. The bole of these trees was colonized by the California flatheaded borer, *Melanophila californica*. The enigmatic absence of the Jeffrey Pine Beetle in these mountains (present to the north and to the south in the Sierra Martir) sparked a lively discussion. We discussed the hypothesis that the RTB may be killing these trees and then they are colonized by *M. californica*. The RTB vectors the pathogenic bluestain fungus, *Leptographum terebrantis*. We also observed *Ips paraconfusus* colonizing broken branches. This may be a new host record for this species as *I. pini* is the most common *Ips* spp colonizing Jeffrey pine throughout its range. *I. paraconfusus* has been collected in Jeffrey pine in the McCloud Flats area near Mt. Shasta. We had fun!!

Fourth Stop: Paso Picacho Campground where the group heard about the 2003 fires, fire ecology, management and restoration at Cuyamaca Rancho State Park (Rich Minnich, UC-Riverside)

Fred Baker

Rich Minnich discusses fire ecology

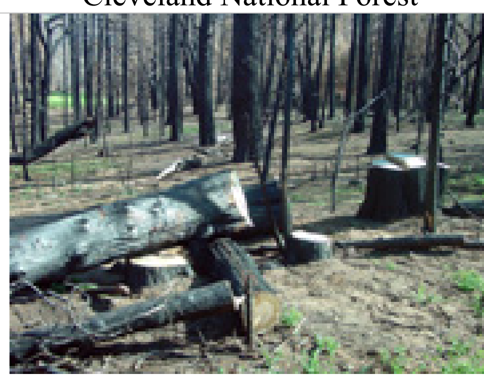
John Wenz directs traffic

Paso Picacho Campground at the eastern edge of the October 2003 Cedar Fire

Cedar Fire

Post-fire debris management on the Cleveland National Forest

Cedar Fire



Cedar Fire

San Diego WIFDWC/WFIWC Field Trip
April 28, 2004
Laura Merrill, John Pronos, John Wenz, co-Organizers
Submitted by John Wenz

The all-day field trip visited locations in the Laguna Mountain area east of San Diego on the Descanso Ranger District, Cleveland National Forest and the Cuyamaca Rancho State Park. Approximately 140 people participated in the field trip.

Presenters included Tom Gillett (District Ranger), Nancy Hoogerland and Russ Lajoie Descanso Ranger District; Acree Shreve and Bernice Bigelow, Cleveland National Forest; Tim Paine and Rich Minnich, University of California, Riverside; Diana Six, University of Montana, Missoula; Dave Wood, University of California, Berkeley (retired); Bob Scharpf, Pacific Southwest Research Station (retired); Jim Dice, Colorado Desert District, California State Parks; and John Kliejunas, Laura Merrill and John Pronos, FHP, Region 5.

The trip started with a discussion of the complex resource and public management challenges facing the Descanso District and Cleveland National Forest including background information on the recent wildfires in southern California and the Cedar Fire in particular followed by a history of pest management on Laguna Mountain. The second stop (Burnt Rancheria Campground) initiated discussion on insect and disease pest complexes. Jeffrey pine beetle was discussed as well as dwarf mistletoe and hazard tree management in developed recreation sites. The pest complex discussion continued at El Prado/ Laguna Campground where historical and current bark beetle, woodborer, pine engraver and annosus root disease interactions were discussed. The history and current application of research on western dwarf mistletoe in Jeffrey pine was also covered. The field trip concluded in the Paso Picacho area of Cuyamaca Rancho State Park, much of which was burned as part of the 273,000 acre Cedar Fire. Discussions included fire ecology and management in southern California and multi-agency restoration efforts for the Cedar Fire.

	TREE SPECIES									
PEST SPECIES	**Ponderosa pine**, *Pinus ponderosa* Laws.	**Sugar pine**, *Pinus lambertiana* Douglas	**Jeffrey pine**, *Pinus jeffreyi* Grev. & Balf.	**Coulter** pine, *Pinus coulteri* D. Don	**White fir**, *Abies concolor* (Gordon & Glend.) Lindley	**Singleleaf pinyons**, *Pinus monophylla* Torrey & Fr□mont, and *P. californiarum* ssp. *californiarum* D.K. Bailey	**Parry pinyon**, *Pinus quadrifolia* Parl.	**Incense cedar**, *Calocedrus decurrens* (Torrey) Florin	**Giant sequoia** (not native to southern California), *Sequoiadendron giganteum* (Lindley) Buchholz	**California black oak,** *Quercus kelloggii* Newb.
Western pine beetle, *Dendroctonus brevicomus* LeConte	X			X						
Mountain pine beetle, *Dendroctonus ponderosae* Hopkins	X	X		(X)		(X)				
Jeffrey pine beetle, *Dendroctonus jeffreyi* Hopkins			X							
Red turpentine beetle, *Dendroctonus valens* LeConte	x	x	x	x		x				
Pine engraver beetles, *Ips* spp.	x	x	x	x						
Pinyon pine engraver, *Ips confusus* (LeConte)						x				
California flatheaded borer, *Melanophila californica* Van Dyke	X	x	X	x						
Fir engraver, *Scolytus ventralis* LeConte					x					
Fir roundheaded borer, *Tetropium abietis* Fall					x					
Ambrosia beetles, *Monarthrum* **spp.**										x
Oak bark beetles, *Pseudopityophthorus* spp.										x
Dwarf mistletoe, *Arceuthobium* spp.	x	x	x	x		x				
White fir mistletoe, *Phoradendron pauciflorum*					x					
Oak mistletoe, *Phoradendron villosum* subsp. *villosum* (Nutt.) Nutt.										x
Annosus root disease, *Heterobasidion annosum* (Fr.) Bref.	X	X	X	X	X			X	X	
Armillaria root disease, *Armillaria mellea* (Vahl:Fr) Kummer	x	x	x	x	x					x
Black stain root disease, *Leptographium wageneri* (Kendrick) M.J.Wingfield						X				

Note: Size of the "X" refers to the ability to kill vigorously growing trees. "X" in parentheses is an occasional host.

The Jeffrey pine beetle occurs in the San Bernardino Mountains but not in the mountains of Riverside and San Diego Co.

Black stain root disease occurs in the San Bernardino Mountains but has not been found in other portions of southern California.

WIFDWC

Minutes of the 2004 Business Meeting
Committee Reports
Past Meeting Information
Outstanding Achievement Award
Bylaws

WIFDWC Business Meeting Minutes
Thursday, April 29, 2004

Ellen Goheen, Chair

Submitted by Blakey Lockman

Chairperson Ellen Goheen called the meeting to order at 4:30 pm, local time.

Thanks were extended to: this year's organizers John Kliejunas and John Pronos; Hadrian Merler, for work on the program- we had good integration within the program; webmaster Judy Adams; secretary- Blakey Lockman for information on announcements and updating our email list. The email list is held by Dale Bergdahl at the University of Vermont. WIFDWC@list.uvm.edu

We have a large contingent of retirees attending this year's meeting: Tom Lorrent, Bob Gilbertson, Bob Scharpf, and Geral McDonald. We greatly appreciate their participation!

The minutes of the 2003 WIFDWC business meeting in Grants Pass, Oregon were approved as posted on the website.

Treasurer's Report- John Schwandt had to leave the meeting early, so Ellen reviewing his notes. As of 4/30/2004 our WIFDWC balance is $4,648.61. This includes an estimate of $2500 for printing/mailing of the 2003 proceedings. We may also have some expenses related to the proceedings of 2004 as well as helping out with Ron Nielsen's travel for this meeting. In addition we have $2,170.66 that belongs to the Hazard Tree Committee.
(The total amount in our bank account including both balances is $**6,819.27**). An itemized report will be included in the proceedings.

Treasurer's report approved as amended by treasurer.

Future Meetings

2005

Interim Chair: Jim Hoffman. Please get ideas to him. Jim has received four ideas already! Jim Worral from the Nominations Committee has selected MaryLou Fairweather as Chair, Hadrian Merler as Secretary. Both of these selections were approved.
Report from Jim Hoffman: Currently have made reservations at the Snow King Resort in Jackson, Wyoming It is at the base of the ski hill on the edge of town. Rooms have recently been renovated and they will be expanding. The resort will have a new name at the time of our meeting, but don't know the new name as yet.
Date: September 26-30, 2005.
Amenities: Close to Grand Teton NP and Yellowstone NP. Highlights for field trip include fire/pathogen interactions, comandra blister rust, and white pine blister rust. The last week of September is ALWAYS sunny. Cool nights and warm days.

2006

Smithers, British Columbia, Canada. Hadrian Merler shared report from Alex Woods (who was unable to attend this year's meeting). Plan to have a salmon barbeque, and spend time looking at Dothistroma needle blight as well as other exciting things. The date is not solid yet.

2007

Discussion: Who would like to host? Whose turn is it? Southwest? How about Taos to look at monster root disease center? Mary Lou Fairweather suggesting somewhere in the southwest. She will recruit Borys Tckaz to help put together a formal nomination.

Committee Reports and Old Business

Rust Committee- The committee met but did not make a report at the business meeting.

Hazard Tree Committee- John Pronos reported that Pete Angwin showed slides of Ouray for the upcoming Hazard Tree Workshop. Hazard Tree training agenda topics- may share Powerpoint presentations of others' HT training. Explore the possibility of a publication on decays of importance in hazard trees.

Dwarf Mistletoe Committee- Fred Baker reported 17 people attended, but not much to report for the business meeting.

Root Disease Committee- Ellen Goheen reported that 34 people attended. Good discussions, which helped Kerry Briton with her questions. See proceedings for more details!

Nursery Pathology Committee- Bob James reported that six people werepresent. They mostly listened to Will Littke. Plan to meet again Friday morning.

Outstanding Achievement Award Committee- Current chair, Greg Filip reported. Greg, Don Goheen and Stefan Zeglen are present members of the committee. They have asked Dave Shaw to replace Greg Filip (his term ends). Greg Filip suggesting some changes to OAA and to also go through the Honorary Lifetime Membership list.

Some changes to the bylaws were proposed by current chair of the OAA committee, Greg Filip, regarding the Outstanding Achievement Award. Under the "Selection Process," the words "The awards Committee will be selected annually…" were changed to "**One new** Awards Committee member will be selected annually…" Under "Award" the words "The award winner will be announced at the banquet" were changed to "The award winner will be announced **during the current meeting**." Under "Nomination Procedures" the following words were proposed: "Excerpts or summaries of nomination letters and letters of support for the award winner can be printed in the WIFDWC Proceedings, but names of the authors of the letters should not be published." All proposed changes were voted on and passed unanimously.

Honorary Lifetime Membership
At the 2003 meeting in Grants Pass, the chair of the Outstanding Achievement Award committee, Greg Filip, was asked to present a summary of the history of Honorary Life Membership to clarify some of the confusion regarding definitions and procedures determining HLM selection and privileges. A full report is included in these proceedings, with the following summary listed here:

- HLMs are defined by meeting attendance and retirement status
- New WIFDWC member retirees need to notify the WIFDWC chair for HLM status
- Non-WIFDWC members need to be proposed for HLM and have members present at the business meeting reach consensus to receive HLM status
- HLMs receive at least a 50% reduction in registration fees and a free copy of the Proceedings
- HLMs who don't attend the meeting receive a free copy of the Proceedings if they want one- to be queried by the secretary

2004 additions to the HLM list were determined to be:

- Duncan Morrison
- John Muir
- Geral McDonald
- Rich Hunt
- Mike Schomaker
- Clive Brasier

It was approved to put the WIFDWC bylaws in proceedings and on the website.

WIFDWC CDs- Fred Baker- They will be for sale for $45 until July 1, then will be $55. Order form and CDs present at meeting.

New Business

Clarification of Executive Committee- Ellen suggesting to add webmaser to list of Executive Committee. Present Executive Committee consists of: chair, secretary, treasurer, program chair, historian, and local arrangements. Historian and treasurer voted on every 5 years. Duncan has been the historian for approximately 20 years. Webmaster has become an integral part of executive committee. It was motioned and approved to make the webmaster an official position on the executive committee.

Everett proposed that at the next meeting, Don Goheen organize an official exhibition of forest pathology memorabilia. Don Goheen agreed and has suggested white pine blister be the topic for the 2005 exhibit. We will give it a try for the Jackson meeting. This may be a start for preserving this history. For instance- where is the OAA hat? Everett is supposed to have it in order to pass it on to Bob James.

Meeting adjourned at 5:25 pm.

Treasurer's Report, 52nd WIFDWC

Submitted by John Schwandt

2004

The following is a summary of transactions for the WIFDWC account since 12/31/2003.

For those that need it for travel, our Federal Tax Id. number is: #91-1267879

Transaction	Income	Expenses	balance
WIFDWC Balance reported in last report (as of 12/31/2003):			***$7,873.61***
4/26/2004 Joint WIFDWC meeting – San Diego, California			
Registration and costs handled by Entomologists			
Final reconciliation will be in next report			
(Balance from 2004 meeting -- unknown)			
Other Account Activity:			
Awards		75.00	7,798.61
Printing/binding/mailing of 03 Proceedings	(estimate)	2,500.00	5,298.61
Bank Interest/dividends/service charges			
2005 WIFDWC – Jackson, Wy			
Reservation fee for conference center		650.00	
WIFDWC Balance as of 4/30/04			**4,648.61**
Hazard Tree Balance – last report			**2,420.66**

Ouray, Colorado Meeting Room Resv.			250.00
Hazard Tree Balance as of 4/30/04			**2,170.66**
Total Bank Balance as of 4/30/04			**$6,819.27**

Hazard Tree Committee Report

Submitted by John Pronos, Chair
April 27, 2004

The meeting was attended by 27 people and marked the 10th anniversary of the Hazard Tree Committee. The first meeting of this committee was at the combined insect and disease work conference in Albuquerque in 1994.

Pete Angwin showed slides of recreation areas in Region 2 (Colorado) from when he worked at the Forest Health Protection (FHP) Gunnison Service Center. These sites will be visited during the upcoming 4th Western Hazard Tree Workshop in June, 2004 at Ouray, Colorado. It will be interesting to see how the management of these areas has changed based on input from FHP.

Training is an important part of hazard tree management. In an attempt to determine if there are opportunities to standardize training sessions, we compared topics covered during sessions in different western FHP offices. Most sessions were 1 to 2 days long, and included between 2 and 5 hours of field exercises. Topics that were common in most training agendas included: hazard tree recognition (defects); survey methods for rating trees; legal issues or responsibilities; how to detect, evaluate and mitigate and monitor hazard trees; elements of hazard tree programs; tree anatomy; forest insects and diseases in recreation sites; and wood decay and conks.

Several members of the Hazard Tree Committee are planning to prepare a publication that would describe the important decay fungi that contribute to tree failures. The focus would be on identification of conks and decayed wood plus what hosts were affected and where the fungi are found. This publication was suggested by people from the International Society of Arboriculture (ISA) who believe that existing publications address volume loss due to decay but not the role of decays in tree failures. John Schwandt prepared a table that includes most of the common wood decays which will be used to decide which fungi to include. ISA may be a source of funding to print this publication.

2004 Dwarf Mistletoe Committee Report

Submitted by Fred Baker, Chairperson

I. Taxonomy, Hosts and Distribution

Shaw, D.C., D.M. Watson, and R.L. Mathiasen. 2004/5?. Comparison of dwarf mistletoes (*Arceuthobium* spp., Viscaceae) in the western United States with mistletoes (*Amyema* spp., Loranthaceae) in Australia—ecological analogs and reciprocal models for ecosystem management. Australian Journal of Botany. In press.

II. Physiology and Anatomy

F.C. Meinzer, D.R. Woodruff, and D.C. Shaw. 2004. Integrated responses of hydraulic architecture, water and carbon relations of western hemlock to dwarf mistletoe infection. Plant, Cell, and Environment. In press.

III. Life Cycles

IV. Host-parasite Relations

V. Effects on Hosts

VI. Ecology

I am still trying to publish our work on spatial patterns of hemlock dwarf mistletoe on the 12 ha plot surrounding the Wind River Canopy Crane, but reviews just back from Canadian Journal of Forest Research ask for MAJOR revisions. Dave Shaw, Wind River Canopy Crane Research Facility.

Jennifer French, a Masters student from the University of Washington did a study on the pollination ecology of hemlock dm around the canopy crane last summer (2003). She bagged some plants and will be following up on fruit set in a few months. Look for her story to come out in the future! Dave Shaw, Wind River Canopy Crane Research Facility

VII. Genetics

VIII. Management

Effects of prescribed fires on dwarf mistletoe infection in southwestern ponderosa pine.

We have continued to monitor the effects of several prescribed fires (underburns) on dwarf mistletoe infection in ponderosa pine. Results are presented from three fires conducted in 1995, 1996, and 1997 on the Santa Fe National Forest, Espanola Ranger District. Average crown scorch on six monitoring plots (a total of 877 sample trees) ranged from 28 to 77 percent; tree mortality ranged from 9 to 36 percent. Infection levels (DMRs) were reduced on all plots, with reductions ranging from 0.3 to 1.6, compared to projected values, 3 to 4 years after the fires. Scorch pruning contributed to reductions in DMR on all plots. Similar results have been observed in more recently burns. Dave Conklin, Region 3

Emergence of latent dwarf mistletoe infection in young ponderosa pine regeneration

Ten year post-treatment results are presented for a dwarf mistletoe control project on the Mescalero Apache Reservation. Over 1200 ponderosa pine seedlings and young saplings have been monitored in an area treated (essentially clearcut) for severe dwarf mistletoe infection in 1991 and 1992. By 2001, fifteen percent of these small trees had developed visible infection (plot range 6.3 to 24.7 percent). Nearly all of the infections were latent (present but invisible) at the time of treatment. The proportion of trees with latent infection increased with increasing height. Only about five percent of trees below "knee-high" at the time of treatment have developed infections. Eighteen percent of the infections detected to date did not sprout until six to nine years after treatment. Dave Conklin, Region 3

Comparison of dwarf mistletoe behavior and stand development in treated and untreated areas

Monitoring plots containing a sample of 265 ponderosa pine were installed following a dwarf mistletoe sanitation-thinning treatment on the Carson National Forest in 1991. From 1992 to 2002, average dwarf mistletoe ratings (DMRs) increased from 1.20 to 2.12 (0.92) in the treated area, and from 2.20 to 2.44 (0.24) in an adjacent untreated area. The greater increase on the treated plot was a function of both a more rapid intensification of mistletoe on infected trees on that plot and the death of several heavily-infected trees on the untreated plot. Average diameter growth over the 10-year period was 2.2 inches on the treated plot and 1.0 inches on the untreated plot; growth was markedly reduced on both plots in the second five-year period because of drought. Tree mortality was four times higher on the untreated plot, and mortality was strongly correlated with dwarf mistletoe infection on this plot. Regeneration was healthier and more abundant on the treated plot. Dave Conklin, Region 3

IX. Surveys

Forest Inventory and Analysis plots suggest that black spruce mistletoe occurs in 8% of the stands in the north central region, and that losses are slight. Other surveys estimate incidence at 10-20%. Given that this mistletoe kills tress quickly, significant areas should be out of production, certainly more than the 8%. We will be visiting stands with FIA plots in them, and will compare FIA results with current losses estimated using GPS-based surveys, and with projected losses using DMLOSS. Fred Baker, Utah State University; Mark Hansen and John Shaw, USDA FS FIA, and Manfred Mielke, USDA FHM.

We are slowly attempting to survey the Wind River Experimental Forest (WREF) for dm. So far we have completed surveys of the TT Munger RNA and the entire Panther Creek Division of the

WREF. The TTM, a 500 yr old forest is about 75% infected, the Panther Creek Division, a 150 yr old Doug fir dominated forest is about 2.5% infected. We hope to put a story together soon concerning hemlock dwarf mistletoe development in the Cascade Mt. fire regenerating forests. Dave Shaw, Wind River Canopy Crane Research Facility

X. Modeling

A biological control module has been added to the spread and intensification model of the spatial statistical dm model in FVS. (Don Robinson, ESSA Technologies, Brian Geils, Simon Shamoun, Bart van der Kamp, and John Muir) A multi stand version of the model has also been completed. Efforts to link the spatial statistical dm model to other models (Tree and Stand Simulator and the FORECAST/FORCEE individual tree models.

XI. Miscellaneous

Terry Shaw reports finding *Viscum album* on *Pinus nigra* at Mt. Olympus in Greece last month

John Pronos reports that the gray pine dwarf mistletoe FIDL (#173) is nearing completion. The FIDL will be printed in R-5 through the Government Printing Office has been approved and the leaflet should be available by late summer or early fall.

Root Disease Committee Meeting

Submitted by Ellen Goheen, Chair
April 29, 2004

34 people attended the Root Disease Committee Meeting. Three items were on the committee's formal agenda:

1) Blakey Lockman, Plant Pathologist, USDA Forest Service, Forest Health Protection in Montana and Idaho presented results of a recent annosum root disease survey completed in Region 1. She also began a dialogue regarding if and when to apply Sporax® to prevent infection by *H. annosum* during fire salvage logging. Time since the fire and size of stumps appear to be critical considerations when answering that question; however, it was generally agreed that Sporax® may be an essential component of a disease prevention strategy during fire salvage operations. Blakey is interested in discussing this matter further with those who have experience or ideas.

2) Kerry Britton, Staff Plant Pathologist, USDA Forest Service, FHP in Washington DC opened what turned into a very lively discussion about our ability to clearly state the impacts caused by the various root diseases when large scale impact data is limited, nonexistent, or untrustworthy. She posed the questions a) Is the lack of consistent large scale impact data interfering with our ability to show how root diseases constrain management options? b) Is it worth the hard work it will take to go after those impact data? c) Can we use hazard and risk assessments as a basis for

obtaining the information we need to show the big picture regarding root disease impacts? And d) are the large scale thinning treatments we propose for fuel reduction setting us up for future large scale root disease impacts? There was general agreement that we must obtain quality root disease data at the western scale (Canada included) and that we may have to look into some changes in funding structure to do that. There is also the need to be involved with those prescribing fuel reduction treatments in the light of potential root disease impacts. Kerry will be continuing this discussion with interested participants in the coming months. Borys Tkacz (USFS FHP FHM) pledged to work with Kerry on ways to obtain better root disease impact information through the Forest Health Monitoring tie to Forest Inventory. It was agreed that this topic may be appropriate for a panel at the 2005 meeting.

3) Committee Chair Ellen Michaels Goheen announced that she is stepping down as committee chair. She has held the position since 1996 and feels its time to pass the opportunity (and the glory!) on. Brennan Ferguson has agreed to take over as Root Disease Committee Chairman effective the 2005 WIFDWC meeting in Wyoming.

The remainder of time allotted was spent in a round-robin of root disease-related announcements and study results. These include: John Kliejunas (USFS FHP R5) announced that Sporax® risk assessment work is being revived and a final risk assessment should be completed within the next year. Steve Jeffers (NC State) reported on work he is doing to test chestnut blight-resistant chestnut trees for susceptibility to *Phytophthora cinnamoni*. Kathy Lewis (UNBC) is working on genetic diversity of *Inonotus tomentosus* and Lori Trummer (USFS FHP R10) is seeing site-based differences in growth and volume loss related to tomentosus root rot. Dave Shaw (UW) is hoping to follow up on laminated root rot plots that were established in the 1920's, using plot data to validate the Western Root Disease Model (WRDM). Helen Maffei (USFS FHP R6) is also working on WRDM validation using plot data from permanent plots she established in Sisters and Klamath Falls, OR. Bill Otrasina (USFS SRS) continues work on population genetics of *H. annosum* and is also working on interactions between fire and black stain root disease. Hadrian Merler (BC MoF) reiterated the need to make the case for root disease impacts in a world responding to large scale bark beetle outbreaks and fires. He also reported that 1) Mike Cruikshank (CFS PRC) continues working with newly retired Duncan Morrison (CFS PRC) on potential genetic resistance to Armillaria root disease and that they are seeing family differences in Douglas-fir, 2) Rona Sturrock (CFS PRC) has a similar study with Phellinus weirii and is also seeing some familial differences in resistance, and 3) Bart van der Kamp (UBC) and Duncan Morrison have a graduate student working on Armillaria root disease in western larch. Borys Tkacz (USFS FHP WO) discussed upcoming revisions to the US Risk Map that include root disease impacts. Pete Angwin (USFS FHP R5) and Don Goheen (USFS FHP R6) continue to work on various projects related to Port-Orford-cedar root disease. The POC Rangewide Assessment has recently been completed and the POC SEIS is in final stages of completion. Jim Blodgett (USFS FHP R2) has projects on Armillaria root disease and fire in the Black Hills, SD and is assessing Armillaria root disease impacts in Wyoming. Greg Filip (USFS FHP R6) is cooperating with Helen Maffei on the previously mentioned root disease studies in OR and has recently begun a study on annosum stain and decay with Crag Schmitt (USFS FHP R6) in LaGrande, OR. Bob James (USFS FHP R1) has been working on *Fusarium oxysporum*'s role in Koa wilt in Hawaii. He also reported hat Sue Hagle (USFS FHP R1) is assessing causes and impacts of the recently-observed decline of western redcedar.

Thanks were extended to the group by Ellen for keeping individual reports short and to the point AND for the excellent discussion that took place throughout the meeting.

The meeting was then adjourned.

Respectfully Submitted
Ellen Michaels Goheen, Root Disease Committee Chairperson

Rust Committee Report

Submitted by John Schwandt, Acting Chair
April 27, 2004

The rust committee breakfast was held on Tuesday, April 27, 2004, with 21 participants providing interesting reports of recent, current, and pending activities. A few highlights are summarized below:

Holly Kearns/Bill Jacobi -- conducting surveys on limber pine in Wyoming and Colorado for blister rust. Holly has found higher rust incidence in Wyoming than Colorado even though Colorado is generally wetter and has more abundant ribes populations. Streams do not seem to be very significant in relation to rust incidence but ribes populations are important. Holy is looking at canker growth rates on branches for her MS degree and will be conducting data analysis this year.

Jim Hoffman – has been working with Bill Jacobi and the Rocky Mountain "cooperative", looking at several species of 5-needle pines and rust incidence. Geral McDonald reported that foxtail and bristlecone pines are highly susceptible, so even isolated populations need to be monitored for rust. There is a widespread concern about blister rust moving south into Mexico which also has important 5-nedle pines. His presented a poster with more details.

Brian Geils/ Gene Van Arsdel - Jim Hoffman reported that Brian and Jean are working on a comprehensive guide to ribes species. It will focus on the southwestern species; there are 17 species of ribes in the intermountain west.

Surveys for Blister Rust - Anna Schoettle – is working with bristlecone pine. The national park service is concerned about blister rust since it is an invasive species. They are trying to determine where infections are coming from in order to know if treatments such as pruning might be of value. Forest Health Monitoring funds are being used to help conduct surveys on the Toiyabe NF. **Jerry Lynn Harris** is also doing surveys. **Bill Jacobi** is assisting in installation of permanent plots and weather stations. **Fred Baker** feels the infection period (20 hours or more of 100% relative humidity) may need to be re-evaluated. Bill looks for 6-hour intervals on weather recorders. **Jim Blodgett** is evaluating permanent plots (PTIPS) in the Shoshone this year.

GYE (Greater Yellowstone Ecosystem) workshop – **Gregg DeNitto** gave an update on the workshop planned for June 28 near Yellowstone. The workshop is sponsored by the GYE and organized by Diana Tomback to workout a standard survey protocols to establishing permanent rust monitoring plots in 5-needle pines. There is a great deal of concern about losing whitebark pine especially in areas with high mountain pine beetle populations. There was a lot of discussion about data collection; what to sample; how to sample, etc.

Kerry Britton – gave a brief synopsis of the Denver meeting regarding the 5-needle pine initiative. A committee chaired by Safiya Samman is discussing ways to implement the findings of the initiative; looking at where we can put dollars to get the biggest impact.

Blakey Lockman/ Judy Adams - compiling a database for storing survey information on blister rust in whitebark and limber pines. (See poster for details)

Other Work - WSU – Hutchins - looking into histochemistry and rust behavior.
RMRS – Bryce Richardson - looking for molecular markers and patterns and worldwide patterns in *Cronartium ribicola*.

Amy Eckert (Univ of Idaho) –looking at canker growth rates in F2 (Moscow) plantations. Especially focusing on abnormal cankers to see if canker girdling rates vary in trees with different looking cankers.

(Please note, I tried to capture the most important points of various speakers, but they may not agree with everything I have attributed to them. Therefore be sure to contact the appropriate people for details about these projects; my apologies to anyone I may have misquoted or misinterpreted).

Nursery Pathology Committee Report

Submitted by Robert L. James, Chairperson
April 26, 2004

The Nursery Pathology Committee hosted a discussion session on the afternoon preceding the joint WIFDWC-WFIWC meeting in San Diego. Although the group was small (six participants), the discussions were lively. Most discussions centered around continuing efforts to develop alternatives to pre-plant soil fumigation in bare root nurseries, new pesticides that might be used to ameliorate pathogen-related problems and recent molecular work to characterize populations of *Fusarium oxysporum* in forest nurseries as well as differentiate pathogenic from non-pathogenic strains of the fungus. Discussions of Sphaeropsis blight of pines and Botrytis blight also occurred.

Weyerhauser continues to have an aggressive research program in forest nursery diseases; their work focuses on problems in both the Pacific Northwest and Southeastern United States. Efforts by the USDA Forest Service in tree nursery pathology have continued to decrease during the past few years, primarily because of the emergence of higher priority work such as Sudden Oak

Death and reduced production of nursery stock in federal nurseries. However, recent emergence of *Phytophthora ramorum* in horticultural and ornamental nurseries [called Ramorum Blight], may increase Forest Service pathology involvement in nurseries in the future.

WIFDWC Past Meeting Locations and Executive Committee Officers

Meeting Locations and Executive Officers, 1953-1989

Annual	Year	Location	Chairperson	Secretary/Treasurer	Program Chair	Local Arrangements
1	53	Victoria, BC	R. Foster			
2	54	Berkeley, CA	W. Wagener	P. Lightle		
3	55	Spokane, WA	V. Nordin	C. Leaphart	G. Thomas	
4	56	El Paso, TX	L. Gill	R. Davidson	V. Nordin	
5	57	Salem, OR	G. Thomas	T. Childs	R. Gilbertson	
6	58	Vancouver, BC	J. Kimmey	H. Offord	A. Parker	
7	59	Pullman, WA	H. Offord	R. Foster	C. Shaw	
8	60	Centralia, WA	A. Parker	F. Hawksworth	J. Parmeter	K. Shea
9	61	Banff, AB	F. Hawksworth	J. Parmeter	A. Molnar	G. Thomas
10	62	Victoria, BC	J. Parmeter	C. Shaw	K. Shea	R. McMinn
11	63	Jackson, WY	C. Shaw	J. Bier	R. Scharpf	L. Farmer
12	64	Berkeley, CA	K. Shea	R. Scharpf	C. Leaphart	H. Offord
13	65	Kelowna, BC	J. Bier	H. Whitney	R. Bega	A. Molnar
14	66	Bend, OR	C. Leaphart	D. Graham	G. Pentland	D. Graham
15	67	Santa Fe, NM	A. Molnar	E. Wicker	L. Weit	P. Lightle
16	68	Coeur d'Alene, ID	S. Andrews	R. McMinn	J. Stewart	C. Leaphart
17	69	Olympia, WA	G. Wallis	R. Gilbertson	F. Hawksworth	K. Russell
18	70	Harrison Hot Springs, BC	R. Scharpf	H. Toko	A. Harvey	J. Roff
19	71	Medford, OR	J. Baranyay	D. Graham	R. Smith	H. Bynum
20	72	Victoria, BC	P. Lightle	A. McCain	L. Weir	D. Morrison
21	73	Estes Park, CO	E. Wicker	R. Loomis	R. Gilbertson	J. Laut
22	74*	Monterey, CA	R. Bega	D. Hocking	J. Parmeter	
23	75	Missoula, MT	H. Whitney	J. Byler	E. Wicker	O. Dooling
24	76	Coos Bay, OR	L. Roth	K. Russell	L. Weir	J. Hadfield
25	77	Victoria, BC	D. Graham	J. Laut	E. Nelson	W. Bloomberg
26	78	Tucson, AZ	R. Smith	D. Drummond	L. Weir	R. Gilbertson
27	79	Salem, OR	T. Laurent	T. Hinds	B. van der Kamp	L. Weir
28	80	Pingree Park, CO	R. Gilbertson	O. Dooling	J. Laut	M. Schomaker
29	81	Vernon, BC	L. Weir	C.G. Shaw III	J. Schwandt	D. Morrisno/R. Hunt
30	82	Fallen Leaf Lake, CA	W. Bloomberg	W. Jacobi	E. Hansen	F. Cobb/J. Parmeter
31	83	Coeur d'Alene, ID	J. Laut	S. Dubreuil	D. Johnson	J. Schwandt/J. Byler
32	84	Taos, NM	T. Hinds	R. Hunt	J. Byler	J. Beatty/E. Wood
33	85	Olympia, WA	F. Cobb	W. Thies	R. Edmonds	K. Russell
34	86	Juneau, AK	K. Russell	S. Cooley	J. Laut	C.G. Shaw III
35	87	Nanaimo, BC	J. Muir	G. DeNitto	J. Beatty	J. Kumi
36	88	Park City, UT	J. Byler	B. van der Kamp	J. Pronos	F. Baker
37	89*	Bend, OR	D. Goheen	R. James	E. Hansen	A. Kanaskie

* Joint meeting with Western Forest Insect Work Conference.

Meeting Locations and Executive Officers, 1990-2004

Annual	Year	Location	Chairperson	Secretary	Treasurer	Historian	Program Chair	Local Arrangements	Web Coordinator
38	90	Redding, CA	R. Hunt	J. Hoffman	K. Russell		M. Marosy	G. DeNitto	
39	91	Vernon, BC	A. McCain	J. Muir	K. Russell		R. Hunt	H. Merler	
40	92	Durango, CO	D. Morrison	S. Frankel	K. Russell		C.G. Shaw III	P. Angwin	
41	93	Boise, ID	W. Littke	J. Allison	K. Russell		F. Baker	J. Hoffman	
42	94*	Albuquerque, NM	C.G. Shaw III	G. Filip	K. Russell		M. Schultz	T. Rogers, D. Conklin	
43	95	Whitefish, MT	S. Frankel	R. Mathiasen	K. Russell		R. Mathiasen	J. Taylor/J. Schwandt	
44	96	Hood River, OR	J. Kliejunas	J. Beatty	J. Schwandt		S. Campbell	J. Beatty/K. Russell	
45	97	Prince George, BC	W. Thies	R. Sturrock	J. Schwandt		K. Lewis	R. Reich/K.Lewis	
46	98	Reno, NV	B. Edmonds	L. Trummer	J. Schwandt	D. Morrison	G. Filip	J. Hoffman/J. Guyon	
47	99*	Breckenridge, CO	F. Baker	E. Michaels Goheen	J. Schwandt	D. Morrison	J. Taylor	D. Johnson	J. Adams
48	00	Waikoloa, HI	W. Jacobi	P. Angwin	J. Schwandt	D. Morrison	S. Hagle	J. Beatty	J. Adams
49	01	Carmel, CA	D. Johnson	K. Marshall	J. Schwandt	D. Morrison	A. Kanaskie	S. Frankel	J. Adams
50	02	Powell River, BC	B. van der Kamp	H. Maffei	J. Schwandt	D. Morrison	P. Hennon	S. Zeglen/R. Diprose	J. Adams
51	03	Grants Pass, OR	E. Hansen	B. Geils	J. Schwandt	D. Morrison	H. Merler	E. Michaels Goheen	J. Adams
52	04*	San Diego, CA	E. Michaels Goheen	B. Lockman	J. Schwandt	D. Morrison	H. Merler/K. Lewis	J. Pronos, J. Kliejunas, S. Smith	J. Adams

* Joint meeting with Western Forest Insect Work Conference.

Standing Committees and Chairs, 1994-2004.

Committee	Chairperson	Term
Hazard Trees	J. Pronos	1994-2004
Dwarf Mistletoe	R. Mathiasen	1994-2000
	K. Marshall	2001-2003
	F. Baker	2004
Root Disease	G. Filip	1994-1995
	E. Michaels Goheen	1996-2004
Rust	J. Schwandt	1994
	R. Hunt	1995-2003
	J. Schwandt (acting chair)	2004
Disease Control[a]	B. James	1995-2002
Nursery Pathology[a]	B. James	2002-2004

[a]Disease Control disbanded and Nursery Pathology established in 2002.

WIFDWC Honorary Life Members
Submitted by Greg Filip

At the 2003 meeting in Grants Pass, the chair of the Outstanding Achievement Award committee, Greg Filip, was asked to present a summary of the history of Honorary Life Membership to clarify some of the confusion regarding definitions and procedures determining HLM selection and privileges. The following is a report from the 2004 OAA committee consisting of Greg Filip, Don Goheen, and Stefan Zeglen:

What is an Honorary Life Member (HLM) in WIFDWC?

An excellent history of HLMs was written by John Laut and published in the 1997 WIFDWC Proceedings, p.106. Included here are summaries of that report and excerpts of reports about HLMs in proceedings from 1998 to 2002:

- "Honorary Member" was first termed in 1964 (p.113) and 1967 (p.108)
- 1993 Brief History WIFDWC supplement, "Honorary Life Members" defined
- 1997 Proceed. Brief history of "honorary life members" (HLMs) are defined as "those members of the Conference who have retired from continuous employment in forest pathology."
- 1998 Proceed. Contain the bylaws that include statements about WIFDWC membership and HLMs. "Honorary members are WIFDWC members who have retired from continuous employment in the field of forest pathology." Members were defined: "Membership is open to individuals who are engaged in forest pathology related endeavors in western North America." W. North America was defined. An attendance rule was established, except for Mexico (2 meetings within 5 years).
- 1999 Proceed., "Confusion regarding how HLM in WIFDWC is bestowed" What does "active membership in WIFDWC mean." WIFDWC membership was defined in the bylaws passed in 1998.
- 2000 Proceed. Proposed amendments to the 1998 bylaws, Article 2, concerning HLMs are as follows: "Honorary Life Membership will be automatically awarded to those members of WIFDWC (as defined above [1998 bylaws]) who have attended at least 5 previous meetings of WIFDWC, and have retired from active forest pathology endeavors. Newly retired members who meet this criterion should notify the current WIFDWC Chairperson of their status. Other MEMBERS who have retired but do not meet the attendance criterion [5 meetings], or other outstanding contributors to the field of Forest Pathology, may request, or be proposed for, Honorary Life Membership, to be voted on by secret ballot, by members present at an annual business meeting."
- "A list of HLMs will be published in the Proceedings of each meeting."
- The amendment passed except for the words "to be voted on by secret ballot."

Greg asked if a vote could be taken for non-members that is not secret? The membership decided that a vote, secret or otherwise, was not necessary, only consensus among the members present.

- 2001 & 2002 Proceed. Lists HLMs and states that: "Honorary Life Members are WIFDWC members who have retired from continuous employment in the field of forest pathology." No mention of the attendance rule.

HLM Privileges

- 1998 Proceed. Contain the bylaws and Article 9: "Distribution for each year's proceedings is made to all paid registrants and honorary members who have indicated a desire to receive them and will be made available to others at cost. The secretary will query all HLMs to determine if they want to receive a free copy of the proceedings and only those responding in the affirmative will receive a copy."
- 1999 Proceed. An amendment to Article 7 (meetings) was passed that added the words, "registration will be reduced by half, if possible, for graduate students and HLMs. It will be at the discretion of the WIFDWC Executive Committee for each meeting to offer a further reduction in fees to graduate students and HLMs and to offer reduced fees to others such as retired professionals and visitors."

- 2000 Proceed. An amendment to Article 7 (meetings) was proposed and passed: "A 50% or more reduction in registration fees for HLMs, **to include a copy of the Proceedings**, should be considered by the executive committee, as per Article 7, amended in 1999."
- 2000 Proceed. An amendment to Article 9 "Proceedings" regarding HLMs was proposed: "Distribution of proceedings will be made to all registrants, including HLMs. The Secretary will query all HLMs to determine if they wish to receive a copy of current Proceedings **at cost (printing and postage)**." This amendment failed so "HLMs who wish to receive a copy of meeting Proceedings will continue to do so at **no cost**."

Summary

- HLMs are defined by meeting attendance and retirement status
- New WIFDWC member retirees need to notify the WIFDWC chair for HLM status
- Non-WIFDWC members need to be proposed for HLM and have members present at the business meeting reach consensus to receive HLM status
- HLMs receive at least a 50% reduction in registration fees and a free copy of the Proceedings
- HLMs who don't attend the meeting receive a free copy of the Proceedings if they want one- to be queried by the secretary

WIFDWC Honorary Life Members

Members are presented by year HLM status was conferred; deceased members are designated with “D”)

1956
Don Buckland (D)

1959
Norm Engelhart (D)
John Hunt (D)

1960
Hans Hansen (D)
Albert Slipp (D)
Charles "Doc" Waters (D)

1965
Lowell Farmer
Harold Offord (D)
Willhelm Solheim (D)
Willis Wagener (D)
Ernest Wright (D)

1966
Jesse Bedwell (D)
Warren Benedict (D)
Lake S. Gill (D)
John Gynn (D)
Homer Hartman (D)
James Kimmey (D)
James L. Mielke (D)
Virgil Moss (D)
Conrad Wessela

1967
John Bier (D)
Paul Keener (D)

1968
Toby Childs (D)
Ross Davidson (D)
John Hansbrough (D)
Clarence Quick (D)

1970
D. Reed Miller (D)
Brenton Howard (D)

1972
Thomas "Buck" Buchanan (D)
Hubert "Hart" Bynum (D)

1973
Stuart "Stuie" Andrews (D)
Paul Lightle
Wolf Ziller (D)

1975
Richard T. "Dick" Bingham
David Etheridge
Ray E. Foster (D)
Don Leaphart (D)
Jack Roff

1976
George Harvey (D)
Alex Molnar
Nagy Oshima (D)
Phil Thomas (D)
Bratislav Zak

1977
Ed Andrews
Neil McGregor (D)

1979
Lewis Roth

1980
Linnea Gillman
Donald Graham
Al Tegethoff

1981
Clarence "Clancy" Gordon (D)
Lee Paine

1983
Elmer Canfield
Dwight Hester (D)
Gordon Wallis

1984
Paul Aho
Mike Finnis
Charles G. Shaw (D)
Larry Weir (D)

1985
Robert Bega (D)
Tommy Hinds (D)
Thomas Laurent

1986
Oscar Dooling (D)
Jerry Riffle
James Trappe
John Woo (D)

1987
John Hopkins

1989
Alvin Funk
Neil Martin

1990
William J. Bloomberg (D)
Richard B. Smith
Roy Whitney

1991
Frank G. Hawksworth (D)
Otis Maloy
John "Dick" Parmeter
Robert F. Scharpf
Stuart Whitney
Ed Wicker

1992
Roy Bloomstrom (D)
Charles H. Driver
Bob Harvey
Vidar Nordin

1993
Fields Cobb
John Laut
Arthur McCain
Earl Nelson

1994
Norm Alexander
Roger Peterson
Ralph Williams

1995
Dave French (D)
Ray Hoff
Tom Nicholls
E. Mike Sharon
Richard S. Smith

1996
James Ginns
Kenelm Russell
Jack Sutherland

1997
Tom McGrath
Pritam Singh
James L. Stewart
Allen Van Sickle

1998
Art E. Parker (D)

1999
John Hart
Eugene P. Van Arsdel
Ed Wood

2001
James Byler
David Johnson

2002
Leon Lamadeleine
John Palmer (D)
Art "Doc" Partridge
Michael Srago

2003
Robert L. Gilbertson

2004
Duncan Morrison
John Muir
Geral McDonald
Rich Hunt
Mike Schomaker
Clive Brasier

WIFDWC Outstanding Achievement Award

Award Criteria__________________

Based on a vote at the Business Meeting, October 2, 1998

Purpose—recognize outstanding achievement in the field of forest pathology in western North America. The award will recognize the individual that has contributed the most to the field of forest pathology in Western North America.

Award—The award winner will be announced ~~at the banquet~~ *during the current meeting* (by motion passed at 2004 Business Meeting). The awardee will present a keynote address at the following year's WIFDWC. A list of winners will be printed in the Proceedings. The winner will receive: a framed certificate and some sort of gift to be determined by the award committee. They will also become keeper of the social achievement award[1] hat, tie, etc., for one year or until the award is given again.

Selection Process—The award will be given annually. An Awards Committee composed of three WIFDWC members will determine the awardee. ~~The~~ *One new* Awards Committee *member* (by motion passed at 2004 Business Meeting) will be selected annually by the WIFDWC Executive Committee. The Committee will be comprised of a representative from each of the following—a university researchers, a public agency employee, and one member-at-large. One member should be working in Canada.

Nomination Procedures—WIFDWC members may nominate another member for the award. they may not nominate themselves. An individual may only nominate one person per year. There is no formal nomination form but the following guidelines are provided (printed in the Proceedings, included in a WIFDWC mailing, and available on request from the chairman of the award committee).

- short introductory letter,
- narrative of nominees qualifications, educational background, work history, etc.
- letters of support from other individuals and organizations, and
- copies of a few of nominee's publications.

Nominations are due three months prior to the starting data of the next year's conference and should be sent to the chairperson of the Awards Committee. *Excerpts or summaries of nomination letters and letters of support for the award winner can be printed in the WIFDWC Proceedings, but names of authors of the letters should not be published.* (by motion passed at 2004 Business Meeting)

The Awards Committee may decide to not make an award if suitable candidates are not nominated.

Based on vote at the Business Meeting, August 16, 2000

Awards Committee—committee members serve a three-year term, with one old member leaving each year and one new member elected at the business meeting; committee members were elected for terms ending in 2000, 2001, and 2003 to establish the staggered replacement scheme.

Based on Discussion at the Business Meeting, August 16, 2000

Committee Recommendation—recipient should be a current or active member of WIFDWC, still active in forest pathology; awards should not be separated into research and non-research; recognizing two recipients in 2000 was a unique situation (not to be repeated) since the award had just been established and not given for the initial year.

Based on Business Meeting, October 9, 2002

Committee Chairperson—the most senior committee member automatically becomes the chairperson.

[1] The social achievement award retired in 1997.

2004 WIFDWC OUTSTANDING ACHIEVEMENT AWARD

Submitted by Greg Filip

Greg Filip presents 2004 Outstanding Achievement Award to Bob James

In 2004, the OAA committee consisted of Greg Filip (chair), Don Goheen, and Stefan Zeglen. The OAA was presented to Bob James at the San Diego meeting. Excepts from the nomination letters are as follows:

"He has always given of his time and expertise to anyone, anywhere, of any question asked of him. He is a great resource to us all and is deserving of the recognition."

"He is an excellent scientist and diagnostician. He does an outstanding job with publishing and working with the nursery community to transfer knowledge."

"Bob is an excellent mentor. He has taken the time to share his experience and worked with me to develop my skills in nursery pathology. He is always willing to help me with pathogen identification, advice on disease control methods and reviews of reports. I have benefited greatly from his published works and know they will be invaluable to me and others long into the future."

Past Outstanding Achievement Awards

Year [a]	Location	Recipient	Achievement Summary
2000	Waikoloa, HI	Lew Roth	For pioneering work on Phytophthora lateralis, Armillaria, and dwarf mistletoes, and for inspiration and leadership of a generation of plant pathology students and colleagues.
2000	Waikoloa, HI	Duncan Morrison	For long-standing contributions to forest pathology research, especially in root diseases and tree hazards.
2001	Carmel, CA	Robert Gilbertson	For contribution to the taxonomy and identification of wood-inhabiting basidiomycete fungi.
2003	Grants Pass, OR	Everett Hansen	For providing strong leadership in forest pathology research and management in the Pacific Northwest.
2004	San Diego, CA	Bob James	For outstanding work in publishing and working with the nursery community to transfer knowledge.

[a]No nominations received for 2002.

BYLAWS OF THE WESTERN INTERNATIONAL FOREST DISEASE WORK CONFERENCE

Passed by Vote of the Assembly at the Business Meeting October 2, 1998

Article I
Objectives_____________________

The Western International Forest Disease Work Conference (WIFDWC) was formed in 1953 to provide a forum for information exchange among forest pathologists in western North America. The primary objectives of the organization are:

- To exchange information on forest pests and related matters through periodic meetings and other appropriate means,
- To promote education, research and extension activities in forest pathology,
- To sustain and improve the health of western North America's forests.

Article 2
Membership____________________

Membership is open to individuals who are engaged in forest pathology related endeavors in western North America. These include but are not limited to: research, survey, management, teaching or extension activities pertaining to tree diseases, forest health, or deterioration of forest products.

Western North America is defined as Canada: British Columbia, Yukon, Alberta, Manitoba, Saskatchewan; United States: Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Alaska, Hawaii, Guam, the Commonwealth of the Northern Marianna Islands and other Pacific Islands in Micronesia; and all of Mexico.

Membership is established after attending one Western International Forest Disease Work Conference. Members must attend another Western International Forest Disease Work Conference within 5 years or their membership is no longer valid.

~~Honorary members are WIFWDC members who have retired from continuous employment in the field of forest pathology. A list of honorary members will be published in the Proceedings of each meeting.~~ [replaced with text below at 2000 Business Meeting].

Honorary Life Membership will be automatically awarded to those members of WIFDWC (as defined above) who have attend at least 5 previous meetings of WIFDWC, and have retired from active forest pathology endeavors. Newly retired members who met this criteria should notify the current WIFDWC Chairperson of their status. Other members who have retired but do not meet the attendance criteria, or other outstanding contributors to the field of Forest Pathology, may request, or be proposed for Honorary Life Membership, by members present at an annual business meeting.

A list of Honorary Life Members will be published in the Proceeding of each meeting.

A 50% or more reduction in the registration fees for Honorary Life Members, to include a copy of the Proceedings, should be considered by the Executive Committee, as per Article7, amended in 1999. [as amended and passed at 2000 Business Meeting]

Article 3
Officers_________________________

WIFDWC officers will include a chairperson, secretary, treasurer, historian, and *webmaster* (as amended and passed at 2004 Business Meeting). The chairperson and secretary will be elected by majority vote of the membership at the annual business meeting. If there is no majority, an acting chairperson will be appointed by the current chairperson. The tenure of the chairperson and secretary begins at the conclusion of the WIFDWC meeting where they were elected and ends when all business from their year's WIFDWC is completed. The treasurer, and historian will be elected every five years, to serve for the following 5 years.

Executive Committee

The Executive Committee may invite non-member speakers to the annual meeting and pay their travel expenses from conference registration fees [by motion passed in 1999, wording by B. Geils, 2004].

Duties of the Chairperson

At each WIFDWC, the chairperson will run the general and business meetings. The chairperson will appoint an interim program chairperson at the start of each WIFDWC to gather suggestions and opinions to guide the conference in the planning of next year's conference. The chairperson will also appoint three members to serve as the "railroad committee" to nominate candidates for next year's chairperson and secretary (and every fifth year, treasurer and historian). The chairperson may appoint members to assist in conducting the affairs of the Conference including but not limited to: local arrangements chairperson and program chairperson. The chairperson, secretary, treasurer and other appointees together form the executive committtee. The chairperson may also appoint ad hoc committees and their chairpersons as deemed necessary to assist in carrying out the mission of WIFDWC.

In the event that the chairperson cannot carry out their duties, the previous chairperson will carry them out. If other members of the executive committee cannot or will not carry out their duties the chairperson may appoint a replacement.

Duties of the Secretary

The secretary shall maintain the membership and mailing lists. The secretary shall send out meeting notices to the membership, take minutes at the business meeting, and compile and distribute the Conference proceedings.

The secretary will query all honorary life members to determine if they want to receive a free copy of the proceedings and only those responding in the affirmative will receive a copy. [by motion passed in 1999, moved from Article 9]

Duties of the Treasurer

The treasurer shall receive all payments, be custodian of WIFDWC funds, keep an account of all moneys received and expended, and make commitments and disbursements authorized by the chairperson. At the annual business meeting the treasurer shall make a fall report covering the financial affairs of WIFDWC. All funds, records and vouchers in the treasurer's control should be subject to inspection by the executive committee.

Duties of the Historian

The historian will keep a complete set of WIFDWC proceedings and answer any inquires as needed. The historian will contact the WIFDWC secretary and provide the address for mailing the archival copy of the proceedings.

Compensation

Officers will not be compensated for their services.

Non-liability of Officers

The officers shall not be personally liable for the debts, liabilities or other obligations of WIFDWC.

Article 4
Decision Making Process_________

The business meeting will be run by Roberts Rules of Order. Meetings are open to the public and non-members may participate in meetings. Only members may vote.

Decisions will be made by majority, with each member granted one vote. Votes may be called for at the annual business meeting. A quorum is reached when more than 25 members are present.

Article 5
Finances_______________________

Expenditures

The chairperson may authorize expenditures of WIFDWC funds. Checks, orders for payment, etc. may be signed by the treasurer, or other person designated by the chairperson. The executive committee may detemine which and how many, outside speakers they want to invite, and travel costs for such speakers can be paid from registration fees.

Contracts

The chairperson may authorize any officer or agent of WIFDWC to enter into a contract on behalf of WIFDWC. Unless so authorized, no person shall have any authority to bind WIFDWC to any contract.

Gifts

The chairperson or the treasurer may accept on behalf of the WIMWC any contribution, gift, or bequest. Commercial sponsorship of conference special events is not allowed.

Fiscal year

The WIFDWC fiscal year shall begin on the first of January and end on the last day of December.

Article 6
Bylaws________________________

Amendments

Changes to bylaws shall be presented to all WIFDWC members for review. The by-laws maybe amended by a 2/3 majority vote, queried at a business meeting.

Article 7
Meetings_______________________

Frequency

The WIFDWC endorses holding annual meetings but will, on vote of the membership, change the time of any particular meeting when circumstances dictate that such action be taken.

Date

WIFDWC endorses holding meetings in late Summer but will, change the interval between any two meetings when circumstances dictate that such an action be taken.

Registration

Registration will be reduced by half, if possible, for graduate students and Honorary Life Members. It will be at the discretion of the WIFDWC Executive Committee for each meeting to offer a further reduction in fees to graduate students and Honorary Life Members and to offer a further reduced fees to others such as retired professional and visitors. [added by motion passed in 1999]

Article 8
Committees___________________

The following are standing committees of WIFDWC: Hazard Trees Committee, Dwarf Mistletoe Committee, Root Disease Committee, Rust Committee, ~~Disease Control Committee~~ [disbanded 2002], *Nursery Pathology Committee* [established 2002].

Article 9
Proceedings___________________

Papers for each year's proceedings must be submitted to the secretary by November 1 of the year of the meeting.

Distribution of proceedings is made to all paid registrants and honorary members who have indicated a desire to receive them and will be made available to others at cost. ~~The secretary will query all honorary life members to determine if they want to receive a free copy of the proceedings and only those responding in the affirmative will receive a copy.~~[by motion passed in 1999, moved to Article 3]

____

Select Motions and Decisions_____

1998

Outstanding Achievement Award—established.

1999

Honorary Life Members—members added and provisions discussed (see 1996 Proceedings for historic retrospective on HLM).

Assisting Outside Speakers—amendment passed.

Website—Committee Reports and Meeting synopsis by the Chairperson would be posted; web committee (Baker, Muir, and Adams) formed.

2000

Outstanding Achievement Award—staggered committee established and recommendations made.

Joint Meetings with WFIWC—motions passed to meet in 2004, have dual program chairs, form a planning committee in 2001 for the joint meeting.

2001

Disease Control Committee—proposal to reorganize tabled.

2002

Standing Committees—motion passed to disband Disease Control and establish Nursery Pathology Committee.

2004

Outstanding Achievement Award—Some changes to the bylaws for this award were proposed under the "Selection Process" and under "Award" and under "Nomination Procedures". All proposed changes were voted on and passed. See WIFDWC Outstanding Achievement Award submission for details.

Executive Committee- It was motioned and approved to make the webmaster an official position on the executive committee.

F

WFIWC

Minutes of the 2004 Business Meetings

WESTERN FOREST INSECT WORK CONFERENCE
55th ANNUAL MEETING
San Diego, CA

INITIAL BUSINESS MEETING
26 April 2004

Tim McConnell, designated Chair in the absence of Jose Negron, called the meeting to order at 5:10 p.m.

Sheri Smith read the minutes of the 2003 Final Business Meeting. Steve Seybold read the obituary for Dr. Don Dahlsten as part of the 2003 Final Business Meeting notes.

There were 23 people in attendance.

Peter Hall motioned to approve the meeting notes and Ken Gibson seconded the motion.

Announcements:

The photo CD compiled by Ron Billings of the 2003 Guadalajara meeting will be available at the registration desk for $10. The money will go into the Scholarship Fund. Thanks to Ron for his hard work on this.

If you have items for the Silent Auction please bring them down on Wednesday night and give to Ladd.

Thank you letters were written on behalf of the WFIWC to:

Kathy Sheehan for the website development and maintenance.

Tom Hofacker and the Washington Office Forest Health Protection group for the reprints of Western Forest Insects. (need to follow-up to see if it is available in cd)

Treasurer's report:

Submitted and read by Ladd Livingston (attached). Ladd motioned to accept the Treasurer's Report; Peter Hall seconded the motion.

Scholarship committee:

Submitted and read by Darrell Ross (attached).

History Committee:

Submitted by Mal Furniss and Boyd Wickman and read by Danny Cluck (attached).

2003 WFIWC Report:

Mike Wagner gave a short report on the 2003 meeting held in Guadalajara, Mexico. There were about 200 people in attendance. Sixty-four people from the U.S. and Canada, the remaining were from Mexico. About 70 people in attendance from Mexico were students. The meeting resulted in a great amount of cooperation and interactions between entomologists from the U.S and Mexico.

The Conference Proceedings are here and available for those that attended the meeting**.**

Common Names Committee:

Brytten Steed read and submitted the report from the common names committee (attached). Anyone interested in being on this committee should contact Brytten.

Founders Award Committee:

Submitted and read by Ken Gibson.

Dr. Gary Daterman was selected as the 2004 recipient of the WFIWC Founder's Award.

NEW BUSINESS

Nomination Committee – Nominations and elections are needed to replace Jose (Chair), and Sheri (Secretary). Tim McConnell, Danny Cluck and Jennifer Burleigh continue as Councilors. Ladd Livingston will continue as Treasurer.

There was discussion regarding the criteria used to determine who can apply for the Scholarship Award. Some discussion followed regarding if the student needed to be from the West and/or working on Western issues. Darrell Ross indicated that this information is on the Website and has already been determined.

Darrell will formalize any suggested changes (see attached report) for the Scholarship Award and submit at the Final Business Meeting.

There was discussion regarding formalizing what the WFIWC would pay for regarding the travel and registration fees for the Founder's and Scholarship Award recipients. It was decided that this would be discussed further at the Final Business Meeting.

Future meetings:

2005 Somewhere in British Columbia.
2006 North American Forest Insect Work Conference (No one was aware of any planning for this meeting. It was suggested that a site be chosen for 2006 for the WFIWC aside from the North American meeting.

Peter Hall motioned to adjourn the meeting at 6:15 p.m. John Wenz seconded the motion and the meeting was adjourned.

Treasurer's Report

Submitted by R. Ladd Livingston

Highlights of the past year:

- Memorial Donations for Don Dahlsten and Ken Wright. $ 95.00
- Sale of various items. $120.00
- Silent Auction at 2003 meeting in Guadalajara $322.80
- Donations for Scholarship Fund received with 2004 reg. $120.00
- Charges for Commercial Both; 2004 meeting $600.00
- Deposited to Scholarship CD. $537.80

*All monies received are deposited into the checking account. I keep track of the amounts received from donations and sales whose specific purpose is to go into the scholarship funds. These funds, plus any balance over $4,000 from the checking account, are added to the CD's as they mature each year, in mid December. After adding the new funds, the CD's are reinvested for another year.

Current Status of Accounts:

Checking Balance	$4,023.24	
Regular Savings	$1,347.24	These are the funds available for scholarships.
McGregor Fund	$5,120.00	Interest is deposited to regular savings account on a quarterly basis
Memorial Scholarship Fund	$19,932.80	Interest is deposited to regular savings account on a quarterly basis
TOTAL	$30,423.25	

Respectfully, R. Ladd Livingston
Treasurer

22 April 2004

WFIWC Memorial Scholarship Committee Report

2003-2004

Darrell Ross, Chair
Don Dahlsten (deceased)
Sandy Kegley
Steve Seybold
Terry Shore

Brian Aukema, a Ph.D. student at the University of Wisconsin working with Dr. Ken Raffa, was selected as the recipient of the 2003 WFIWC Memorial Scholarship. Because the 2003 WFIWC in Guadalajara, Mexico was 7-8 months later than the normal meeting time, Brain's selection was announced through the WFIWC website and he was notified by email.

There was some confusion as to the amount of the scholarship to be awarded in 2003. It was discovered that the first two recipients of the award received $1,500. However, as of March 2003, there was only $1,521.35 in the account from which the Scholarship funds are drawn, and the account that contributes to these funds was only earning about $400 per year. Consequently, awarding $1,500 in 2003 would have meant that there were little or no funds for a scholarship in 2004 and subsequent years. Referring to the WFIWC website, the description on the Memorial Scholarship stated that the amount of the award would be between $500 and $1,000, so it is unclear why the first two recipients of the scholarship received $1,500. It was decided through email discussion among the WFIWC Executive Committee and the Memorial Scholarship Committee that $500 would be awarded in 2003 and for the immediate future to ensure the continuity of the scholarship. If funds available for the scholarship increase appreciably in the future, we will consider increasing the amount awarded.

It was also discovered that only the first recipient of the Memorial Scholarship in 2001 received a plaque commemorating the award. It was decided that appropriate plaques would be presented to the 2002 and 2003 Memorial Scholarship recipients, and to all future recipients. Plaques were purchased from R3 Engraving in Corvallis, OR for Kevin Dodds and Brian Aukema at a total price of $143.78. Kevin's plaque was delivered to him since he declined to give a presentation at the Guadalajara meeting. Brian's plaque will be presented to him at the San Diego meeting.

There was some confusion regarding the proposed scholarships for Mexican students to be awarded at the meeting in Guadalajara. After some email discussion, it was clarified that those awards were to be totally independent of the Memorial Scholarship and that support for those scholarships was the responsibility of the individuals that proposed awarding them. The Memorial Scholarship Committee did agree to review the applicants for those scholarships and select the recipients. In the end, due to the lack of applicants, no scholarships were awarded to Mexican students.

In October 2003, Steve Seybold agreed to serve on the Memorial Scholarship Committee replacing Don Dahlsten.

In an effort to avoid future confusion regarding the Memorial Scholarship, the Selection Committee recommends the following changes to the description of the award as it currently reads on the WFIWC website under the heading of, "Other information relating to the awarding of the WFIWC Memorial Scholarship":

Item 7 should be changed from:

7. The amount of the award may vary from year to year, but is estimated at between $500 to $1,000 US funds.

to

7. The amount of the award will be $500 US funds.

Two additional items should be added:

8. One scholarship will be awarded each year.
9. The scholarship recipient will be given a small plaque in addition to the financial award.

Seven applications were received for the 2004 Memorial Scholarship. Four of the applications were from students pursuing M.S. degrees and three were from students pursuing Ph.D. degrees. The committee selected Katherine Bleiker, a Ph.D. student at the University of Montana working with Dr. Diana Six, as the recipient of the 2004 Memorial Scholarship.

WFIWC History Committee Report
2003 – 2004

Submitted by M.M. Furniss and B.E. Wickman

A 12-page article by M. Furniss and Roy Renkin, Management Biologist, Yellowstone N.P., was published in the Winter 2003 issue of the American Entomologist. The title is: Forest Entomology in Yellowstone National Park, 1923 – 1957. A time of discovery and learning to let live. It is based on unpublished reports and photos by James C. Evenden and others of the former Coeur d' Alene Forest Insect Lab and similar material in the YNP branch of the National Archives at Mammoth. This is the fifth historical article published in the Heritage section of that magazine since 1997 by members of the WFIWC History Committee.

Boyd Wickman is writing a 16 chapter manuscript entitled: Biographies of H. E. Burke and John M. Miller, encouraged by the Miller and Burke families who provided personal information and photos. Some of Burke's photos have been put on a CD that will be deposited in the WFIWC archives. Burke was the second person hired by A.D. Hopkins in the Bureau of Entomology, Division of Forest Insect Investigations, after its establishment in 1902. He and Miller were prominent in California during the first half of the last century.The PNW Research Station is providing typing and financial assistance. Boyd also is assisting a contract writer for the PNW Station to prepare a draft of the History of forest research in central Oregon. Much of this history centers on the Pringle Falls Experimental Forest, where F. Paul Keen began research in 1931 that resulted in the Keen tree classification by which ponderosa pine trees could be classified according to their susceptibility to bark beetles.

With help from Ladd Livingston and Terry Abraham, Head of Special Collections and Archives, University of Idaho, progress was made in identifying accessions in the archives related to forest entomology. In particular, it was determined that **three WFIWC Proceedings are needed: 1984, 1985 and 1986**. Members who may have one or more of those years available for deposit are requested to communicate that to M. Furniss <MalFurniss@turbonet.com>.

M. Furniss has written an article for Latah Legacy published by the Latah County (Idaho) Historical Society entitled: The 1947 Douglas-fir tussock moth outbreak in northern Idaho: Target of the largest aerial spraying project in western forests. It is illustrated with photos taken by P.C. Johnson of the former Coeur d'Alene Forest Insect Lab. Success of this project led to spraying DDT on 9 million acres of spruce budworm-infested forests in the northwestern United States during 1949-1958. The manuscript was reviewed by Sandy Kegley and will appear in the Fall issue.

Common Names Committee Report 2003 (Nov/Dec) and 2004 (through April)

Submitted by Brytten E. Steed

Committee Members – As of this writing, April 25, 2004, the Common Names Committee (CNC) membership is consists of Lee Humble, Iral Ragenovich, and Chairperson Brytten Steed. Previous member Larry Stipe resigned his membership December 4, 2003. The CNC Rules and By-laws for the WFIWC prescribe a membership of seven. Addition of members will be discussed during the 2004 business meeting. Lee A. Peterson, Entomologist with FHP R1 in Coeur d'Alene, Idaho has volunteered to serve on the committee contingent on approval during the 2004 meeting.

At the initial 2003 WFIWC business meeting, CNC Chairperson Brytten Steed was not present but information on activities in 2003 was presented by WFIWC Chairperson Jose Negron. Chairperson Steed was present at the final business meeting. During this final meeting it was indicated that in addition to the question of CNC membership, there was still interest in pursuing block-approval for common names now listed in the text, Western Forest Insects (Furniss and Carolin 1977), but not approved by ESA. According to the CNC 1999 report there are 473 common names listed for the taxa contained in Furniss and Carolin (1977). Of these, 207 names are not approved ESA names (actually 204 names). To take the formal route of individual submittals to ESA would be a daunting task. We have hopes of simplifying the submittal/approval process on the grounds that the names in question have been in common usage since 1977, or before.

Since the 2003 meeting, Chairperson Steed contacted the Common Names Chairperson for ESA, Tom Phillips, Professor at Oklahoma State University. Using the hardcopy list of names provided by former Chairperson Torolf Torgersen, the list of names proposed in 1999 have been re-entered into an EXCEL format. We have also addressed in the EXCEL file a number of the questions asked in the formal ESA common names application; however, additional input from other specialist on the data submitted may be required. We have submitted the preliminary electronic list (see appendix for hardcopy) to Dr. Phillips to promote the idea of a mass approval with the ESA common names committee. He said he would circulate the list to the ESA committee with our request and justification as given at the top of the list, and solicit feedback on the idea and suggestions for the type of additional information they may need. To date I have not received word as to whether they will approve an expedited mass review of our list.

If the ESA committee approves our proposal, the CNC will need to complete a number of tasks including: 1) double-check all scientific names to determine if any have been changed (note source/citation), 2) list other scientific names, 3) determine if any common names have been submitted by some other person(s) for any of 206 insects, 4) note any other common names that may have been used for these insects (note source/citation), and 5) check all spelling of common and scientific names. Solicitation of input from WFIWC members during the annual meeting could greatly facilitate this process.

In 2003, CNC Chairperson Steed submitted to ESA (via their on-line web form) the common name for *Scolytus schevyrewi* as the Banded Elm Bark Beetle. This submittal was conducted with assistance from a group of specialists on this beetle. The other members of the CNC were not used. The last accepted submission by the CNC was conducted in 1996 for *Trypophloeus striatus*.

During the 2003 meeting it was suggested that the CNC look into common names for woodborers. At present, anyone interested in presently accepted common names for Buprestidae and Cerambycidae look on the ESA common names web site (http://www.entsoc.org/pubs/index.html - common names). Items noted in the 1999 CNC report that may need to be addressed by the CNC include possible submission of a common name for *Nepytia janetae* (per Roberta 'Bobbi' Fitzgibbon, FHP R-3 Flagstaff). In addition, the Committee may work with Ann Lynch to unravel a common name tangle involving conflicting European and U.S. common names for *Elatobium abietinum*. This may ultimately involve proposing a common name change to the ESA CNC.

Common Names Committee Membership as of November 21, 2003.

Brytten E. Steed, Chair (2002)
USDA FS Forest Health Protection, Region 4
4746 S. 1900 E.

Ogden, UT 84403
(801)476-9732; FAX (801)475-1477
e-mail: bsteed@fs.fed.us

Iral R. Ragenovich (1980)
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333 SW First Avenue
P.O. Box 3623
Portland, OR 97208-3623
(503)808-2915; FAX (503)808-2469
e-mail: iragenovich@fs.fed.us

L.M. (Lee) Humble (1990)
Forestry Canada
Forest Insect and Disease Survey
Pacific Forestry Center
506 West Burnside Road
Victoria, B.C. V8Z 1M5
(250)363-0644; FAX (604)363-6005
e-mail: lhumble@pfc.forestry.ca

Founder's Award Committee Report

Submitted by Ken Gibson, Committee Chair

Representing the Founder's Award Committee, it is my pleasure to announce the selection of Dr. Gary Daterman as the 2004 WFIWC Founder's Award recipient. Gary has been notified and has agreed to deliver the Founder's Award Address at WFIWC in Kamloops, April 2005.

At this meeting (San Diego, 2004) there will be a memorial presentation for Dr. Don Dahlsten, 2003 Award recipient. The program will be under the direction of Pat Shea and Tom Eager.

I have in my possession the "traveling" Founder's Award plaque. It may be desirable to discuss a permanent storage location for the plaque. It has been updated to include Gary Daterman.

I will present at this meeting, a motion seeking monetary support for the Founder's Award and Scholarship recipients at the meeting during which they will present their acceptance addresses (normally the year following their award). That should greatly assist, and facilitate their attendance inasmuch as the former are generally retired and the latter students. The motion will be presented for a vote of the WFIWC membership in attendance at this meeting.

WESTERN FOREST INSECT WORK CONFERENCE
55th ANNUAL MEETING
San Diego, CA

FINAL BUSINESS MEETING
29 April 2004

Tim McConnell, designated Chair in the absence of Jose Negron, called the meeting to order at 3:15 p.m.

Tim reviewed the Initial Business Meeting notes.

There were 34 people in attendance.

Announcements:

Plaques were presented to:

Kathy Sheehan for the website development and maintenance.

Tom Hofacker and the Washington Office Forest Health Protection group for the reprints of Western Forest Insects. (need to follow-up to see if it is available in cd)

Treasurer's report:

Ladd Livingston reported that the Silent Auction took in $407. He also reported $70 in the sales of items from previous meetings and $100 in donations during the meeting for the Memorial Scholarship Fund.

The Treasurer's books were audited on April 29, 2004 by Tim McConnell and Sheri Smith.

Anyone interested in helping with the Scholarship Fund raising should contact Ladd.

Scholarship committee:

Darrell Ross recommended that the Student Scholarship information be changed as follows: Under the heading "Other information relating to the awarding of the WFIWC Memorial Scholarship"

Item 7 should be changed to:

7. The amount of the award will be $500 US funds.

Items 8-10 will be added:

8. One Scholarship will be awarded each year.
9. The Scholarship recipient will be given a small plaque in addition to the financial award.
10. The registration fee and 1 nights lodging for the WFIWC will be waived for the meeting that the student is making his/her presentation.

John Wenz motioned to accept these changes as stated by Darrell Ross. Terry Shore seconded the motion. All were in favor, no one opposed.

Darrell Ross reported that there were 7 applicants for the 2004 award. The committee selected Katherine Bleiker, a Ph.D. student at the University of Montana working with Dr. Diana Six, as the recipient of the 2004 Memorial Scholarship.

January 15, 2005 will be the deadline to apply for the 2006 Scholarship.

History Committee:

Kimberly Wallin is newly appointed on the History Committee.

Common Names Committee

Diana Six and Lee Pedersen are newly appointed members on this Committee.

Founders Award Committee:

Ken Gibson announced that Dr. Gary Daterman was selected as the 2004 recipient of the WFIWC Founder's Award.

Ken proposed a changed to the Founders Award as follows:

The registration fee and 1 nights lodging for the WFIWC will be waived for the meeting that the Founders Award recipient is making his/her presentation.

Ken Gibson motioned to make this a permanent change for the Founders Award. Diana Six seconded the motion. All were in favor, no one opposed.

The Founders Award Committee will accept nominations through December 15, 2004. The carryover period for a nomination to remain active is 3 years.

Other Business:

Dennis Haugen reported that he has copies of : Reference: Lingafelter S. W. and E. R. Hoebeke. 2002. Revision of the Genus *Anoplophora* (Coleoptera: Cerambycidae). Entomological Society of Washington, Washington, D.C. 236 pp., free of charge to anyone who wants one.

NEW BUSINESS

Nomination Committee – Nominations and elections were held to replace Jose (Chair), Sheri (Secretary). Tim McConnell nominated Darrell Ross as Chair. Tom Eager seconded the nomination. Ladd Livingston motioned to close nominations, Jill Wilson seconded. Everyone was in favor of Darrell Ross for the next Chair of the WFIWC, no one opposed.

Sheri Smith nominated Lia Spiegel as Secretary. John Wenz seconded the nomination. Jill Wilson motioned to close nominations, John Wenz seconded. Everyone was in favor of Lia Spiegel for the next Secretary of the WFIWC, no one opposed.

Future meetings:

- 2005 - Lorraine reported that the meeting will be in B.C. sometime in March.

2006 North American Forest Insect Work Conference (NAFIWC). Dennis Haugen reported that the north central group is next rotation to host the NAFIWC and that the meeting is likely to be held somewhere in Michigan.

Peter Hall motioned to adjourn the meeting at 6:15 p.m. John Wenz seconded the motion and the meeting was adjourned.

WESTERN FOREST INSECT WORK CONFERENCE
55th ANNUAL MEETING
San Diego, CA

Executive Committee Meeting
26 April 2004

Tim McConnell, designated Chair in the absence of Jose Negron, called the meeting to order at 4:10 p.m.

Present:

Sheri Smith, Secretary
Ladd Livingston, Treasurer
Tim McConnell, Councilor
Danny Cluck, Councilor
Darrell Ross, Chair, Memorial Scholarship Committee
Ken Gibson, Chair, Founders' Award Committee
Brytten Steed, Chair, Common Names Committee

OLD BUSINESS:

There was a need following the 2003 WFIWC meeting to clarify the membership of the Common Names Committee.

Brytten Steed, Iral Ragenovich and Lee Humble are the current members.

At the 2003 WFIWC meeting, Brytten Steed agreed to check into the need to look woodborer common names. See the Common Names Committee report in the Initial Business Meeting notes.

PheroTech will continue to house the Scholarship plaque. Ken Gibson will house the Founder's Award plaque.

Update of Western Forest Insects – Nancy Gillette was to prepare proposal to be presented in 2004 meeting. Nothing was reported on this item.

History Committee Repository – previous minutes indicated a concern about the location due to staffing at University of Idaho library. Jose Negron contacted Mal Furniss to check on this and Mal indicated that it was not an issue. Mal would like to get copies of the following proceedings that are missing from the series: 1984 to 1986.

Tim will ask during the full Business Meetings if someone else would like to serve on the History Committee.

It was mentioned in the 2002 Executive Committee Meeting notes that there was a need to have an official one-page summary describing the WFIWC organization, its goals, and history. This would be available to those wishing to make contributions. At the 2003 WFIWC meeting Tim McConnell agreed to complete this. Tim reported that it has been completed and should be on the web site soon.

The photo CD compiled by Ron Billings of the 2003 Guadalajara meeting will be available at the registration desk for $10. The money will go into the Scholarship Fund. Thanks to Ron for his hard work on this.

Thank you letters were written on behalf of the WFIWC to:

Kathy Sheehan for the website development and maintenance.

Tom Hofacker and the Washington Office Forest Health Protection group for the reprints of Western Forest Insects. (need to follow-up to see if it is available in cd).

Plaques will be presented at the Final Business Meeting.

NEW BUSINESS 2004

Treasurer's report:

Submitted and read by Ladd Livingston.

Highlights of the past year:

- Memorial Donations for Don Dahlsten and Ken Wright. $ 95.00
- Sale of various items. $120.00
- Silent Auction at 2003 meeting in Guadalajara $322.80
- Donations for Scholarship Fund received with 2004 reg. $120.00
- Charges for Commercial Both; 2004 meeting $600.00
- Deposited to Scholarship CD. $537.80

*All monies received are deposited into the checking account. I keep track of the amounts received from donations and sales whose specific purpose is to go into the scholarship funds. These funds, plus any balance over $4,000 from the checking account, are added to the CD's as they mature each year, in mid December. After adding the new funds, the CD's are reinvested for another year.

Current Status of Accounts:

Checking Balance	$4,023.24	
Regular Savings	$1,347.24	These are the funds available for scholarships.
McGregor Fund	$5,120.00	Interest is deposited to regular savings account on a quarterly basis
Memorial Scholarship Fund	$19,932.80	Interest is deposited to regular savings account on a quarterly basis
TOTAL	$30,423.25	

Scholarship committee report:

Submitted by Darrell Ross (Full report in Initial Business Meeting notes).

Brian Aukema, a Ph.D. student at the University of Wisconsin working with Dr. Ken Raffa, was selected as the recipient of the 2003 WFIWC Memorial Scholarship. Because the 2003 WFIWC in Guadalajara, Mexico

The committee selected Katherine Bleiker, a Ph.D. student at the University of Montana working with Dr. Diana Six, as the recipient of the 2004 Memorial Scholarship.

Darrell will recommend several changes at the Full Business meetings to avoid future confusion regarding the Memorial Scholarship

History Committee report:

Submitted by Mal Furniss and Boyd Wickman (Full report in Initial Business Meeting notes).

A 12-page article by M. Furniss and Roy Renkin, Management Biologist, Yellowstone N.P., was published in the Winter 2003 issue of the American Entomologist. This is the fifth historical article published in the Heritage section of that magazine since 1997 by members of the WFIWC History Committee.

Boyd Wickman is writing a 16 chapter manuscript entitled: Biographies of H. E. Burke and John M. Miller, encouraged by the Miller and Burke families who provided personal information and photos.

M. Furniss has written an article for Latah Legacy published by the Latah County (Idaho) Historical Society entitled: The 1947 Douglas-fir tussock moth outbreak in northern Idaho: Target of the largest aerial spraying project in western forests.

Common Names Committee report:

Submitted by Brytten Steed (Full report in Initial Business Meeting notes).

In 2003, CNC Chairperson Steed submitted to ESA (via their on-line web form) the common name for *Scolytus schevyrewi* as the Banded Elm Bark Beetle.

As of this writing, April 25, 2004, the Common Names Committee (CNC) membership is consists of Lee Humble, Iral Ragenovich, and Chairperson Brytten Steed. Previous member Larry Stipe resigned his membership December 4, 2003. The CNC Rules and By-laws for the WFIWC prescribe a membership of seven. Addition of members will be discussed during the 2004 business meeting. Lee A. Peterson, Entomologist with FHP R1 in Coeur d'Alene, Idaho has volunteered to serve on the committee contingent on approval during the 2004 meeting.

Brytten will ask for additional people to be members of the Common Names Committee at the full Business meetings.

Founders Award Committee report:

Submitted by Ken Gibson (Full report in Initial Business Meeting notes).

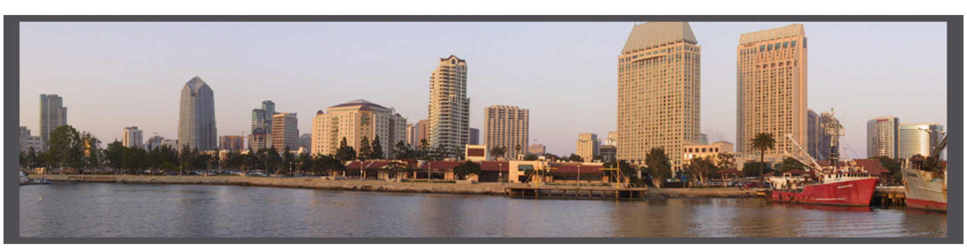
At this meeting there will be a memorial presentation for Dr. Don Dahlsten, 2003 Award recipient. The program will be under the direction of Pat Shea and Tom Eager.

Dr. Gary Daterman was selected as the 2004 recipient of the WFIWC Founder's Award.

NEW BUSINESS

Nomination Committee – Nominations and elections are needed to replace Jose Negron(Chair), and Sheri Smith(Secretary). Tim McConnell, Danny Cluck and Jennifer Burleigh continue as Councilors. Ladd Livingston will continue as Treasurer.
A nomination committee was selected.

WFIWC /WIFDWC Registration List



Meeting Registration List

Last Name	First Name	Com-pany	Address	City	State	Postal Code	Coun.	Email
Adams	Judy	USDA – FHTET	2150 Centre Ave.	Ft. Collins	CO	80526	USA	Jadams04@fs.fed.us
Albers	Mike	MN-DNR	1201 East Hwy 2	Grand Rapids	MN	55744	USA	Mike.albers@dnr.state.mn.us
Angwin	Pete	USFS – FHP	3644 Avtech Parkway	Redding	CA	96002	USA	pangwin@fs.fed.us
Anhold	John	USFS – FHP	2500 S. Pine Knoll Drive	Flagstaff	AZ	86001	USA	janhold@fs.fed.us
Aukema	Brian	Canadian FS	506 W. Burnside Rd.	Victoria	B.C.	V8Z 1M5	Canada	baukema@pfc.forestry.ca
Baker	Fred	USU	5230 University Blvd	Logan	UT	84322	USA	Fred.baker@usu.edu
Beckman	David	ID Dept. of Lands	3780 Industrial Ave. So.	Coeur d'Alene	ID	83815	USA	dbeckman@idl.state.id.us
Bentz	Barbara	RMRS	860 N. 1200 E	Logan	UT	84321	USA	bbentz@fs.fed.us
Billings	Ron	Texas FS	301 Tarrow, Suite 364	College Station	TX	77840	USA	rbillings@tfs.tamu.edu
Blackford	Darren	USDA – FS	4746 S. 1900 E.	Ogden	UT	84403	USA	Dblackford@fs.fed.us
Blodgett	James	USDA – FS	1730 Samco Rd.	Rapid City	SD	57702	USA	jblodgett@fs.fed.us
Bonello	Enrico	Ohio S Univ	201 Kottman Hall, 2021 Coffey Rd.	Columbus	OH	43210	USA	Bonello.2@osu.edu
Booth	Janie	UC Davis	Entomology Dept. 1 Shields Ave.	Davis	CA	95616	USA	jmbooth@ucdavis.edu
Brennan	Leonard	Texas A & M						
Bridgwater	Dave	USDA – FS	P.O. Box 3623	Portland	OR	97208	USA	dbridgwater@fs.fed.us
Britton	Kerry	USFS – FHP	1601 N Kent St RPC 7	Arlington	VA	22201	USA	kbritton01@fs.fed.us
Browning	John	Weyerhaeuser	505 N Pearl	Centralia	WA	98531	USA	John.browning@weyerhaeuser.com
Bulaon	Beverly	USFS – FHP	P.O. Box 7669	Missoula	MT	59807	USA	bbulaon@fs.fed.us
Cain	Robert	USFS	740 Simms St.	Golden	CO	80401	USA	rjcain@fs.fed.us
Caltagirone	Leo	UCB	6600 Gatto	El Cerrito	CA	94530	USA	
Chen	Zhong	NAU	School of Forestry P.O. Box 15018	Flagstaff	AZ	86011	USA	Zhong.chen@nau.edu
Clancy	Karen	USFS-RMRS	2500 S. Pine Knoll Drive	Flagstaff	AZ	86001-6381	USA	kclancy@fs.fed.us
Cluck	Danny	USFS-FHP	2550 Riverside Drive	Susanville	CA	96130	USA	dcluck@fs.fed.us
Cook	Stephen	U of ID	Dept. of Forest Resources	Moscow	ID	83844	USA	stephenc@uidaho.edu
Copren	Kirsten	PSW/ UCD	One Shields Ave.	Davis	CA	95616	USA	kacopren@ucdavis.edu
Costello	Sheryl	RMRS/ CSU	240 W. Prospect	Ft. Collins	CO	80526	USA	sherylc@lamar.colostate.edu
Cota	Jesus	USFS – FHP	1601 N. Kent Strees	Arlington	Virginia	20151	USA	jcota@fs.fed.us

Last Name	First Name	Com-pany	Address	City	State	Postal Code	Coun.	Email
Currie	Cameron	U of KS	1200 Sunnyside Ave.	Lawrence	KS	66045	USA	ccurrie@ku.edu
Dabney	Chri s	USFS-PSW	2480 Carson Road	Placerville	CA	95667	USA	cdabney@fs.fed.us
Dale	John	USFS – FHP	1323 Club Drive	Vallejo	CA	94592	USA	jdale@fs.fed.us
DeNitto	Gregg	USFS – FHP	P.O. Box 7669	Missoula	MT	59807	USA	gdenitto@fs.fed.us
Dreistadt	Steve	UCD	Statewide IPM Program	Davis	CA	95616	USA	shdreistadt@ucdavis.edu
Eglitis	Andris	USFS – FHP	1645 Highway 20 East	Bend	OR	97701	USA	aeglitis@fs.fed.us
Ellenwood	Jim	USDA – FHTET	2150 Centre Ave.	Ft. Collins	CO	80526	USA	jellenwood@fs.fed.us
Elliott	Marianne	U of WA	Box 352100	Seattle	WA	98195	USA	melliott@u.washington.edu
Erbilgin	Nadir	UCB	201 Wellman Hall	Berkeley	CA	94720	USA	erbilgin@nature.berkeley.edu
Erickson	Melissa	PSW	P.O. Box 245	Berkeley	CA	94701	USA	melissaerickson@fs.fed.us
Fairweather	Mary Lou	USFS – FHP	2500 S. Pine Knoll Drive	Flagstaff	AZ	86001	USA	mfairweather@fs.fed.us
Fettig	Christopher	USFS-PSW	1107 Kennedy Place – Suite 8	Davis	CA	95616	USA	cfettig@davis.com
Filip	Greg	USDA – FS	P.O. Box 3623	Portland	OR	97208	USA	gmfilip@fs.fed.us
Flanagan	Paul	USDA – FS	1133 N Western Ave.	Wenatchee	WA	98801	USA	pflanagan@fs.fed.us
Foltz	John	U of FL	P.O. Box 110620	Gainsville	FL	32611	USA	foltz@ufl.edu
Forschler	Brian	U of GA	Department of Entomology	Athens	GA	30602	USA	bfor@uga.edu
Gaylord	Monica	NAU	School of Forestry P.O. Box 15018	Flagstaff	AZ	86011	USA	Mlg36@dana.ucc.nau.edu
Gibson	Ken	USFS – FHP	P.O. Box 7669	Missoula	MT	59807	USA	kgibson@fs.fed.us
Gilbertson	Robert	U of AZ	Dept. of Plant Sciences, Div. Of Plant Biology	Tucson	AZ	85721	USA	rlg@ag.arizona.edu
Gilbertson	Celia		4321 N. Vereda Rosada	Tucson	AZ	85750	USA	
Gilmore	Daniel	U of MN	1861 Highway 169 East	Grand Rapids	MN	55744	USA	dgilmore@umn.edu
Goheen	Ellen	USFS – FHP	2606 Old Stage Rd.	Central Point	OR	97502	USA	egoheen@fs.fed.us
Goheen	Don	USFS – FHP	2606 Old Stage Rd.	Central Point	OR	97502	USA	dgoheen@fs.fed.us
Goza	Mike	UNIVAR USA	2600 S. Garfield Ave.	Commerce	CA	90040	USA	Michael.goza@univarusa.com
Grace	J. Kenneth	U of HI	Dept. of Plant & EPS	Honolulu	HI	90266	USA	kennethg@hawaii.edu
Grady	Kevin	NAU	School of Forestry P.O. Box 15018	Flagstaff	AZ	86011	USA	kcg25@dana.ucc.nau.edu
Hadj-Chikh	Leila	WCS	3985 18th St.	San Francisco	CA	94114	USA	lhadjchikh@wcs.org
Hall	Peter							Peter.Hall@gems6.gov.bc.ca

Last Name	First Name	Com-pany	Address	City	State	Postal Code	Coun.	Email
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