PROCEEDINGS

THIRTYFIRST ANNUAL WESTERN FOREST INSECT WORK CONFERENCE

El Paso, Texas

March 4 - 6, 1980

Executive Committee (Thirtyfirst WFIWC)

W. Ives, Edmonton	Chairman
R.L. Johnsey, Olympia	Immediate Past Chairman
L. Safranyik, Victoria	Secretary-Treasurer
J. McLean, Vancouver	Councilor (1977)
W.M. Ciesla, Davis	Councilor (1978)
M. Stock	Councilor (1979)
G. Lessard	Program Chairman
T. Smith	Local Arrangements Chairman

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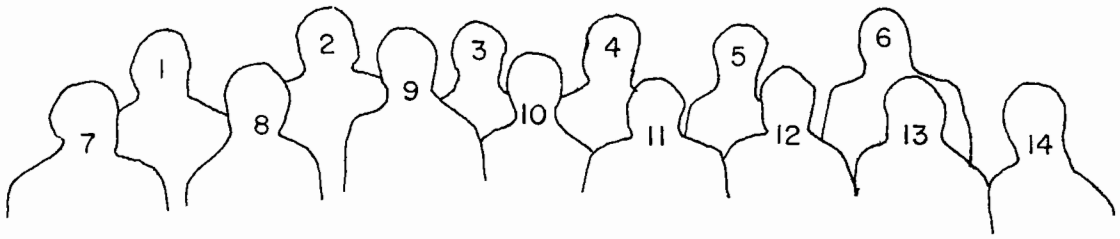
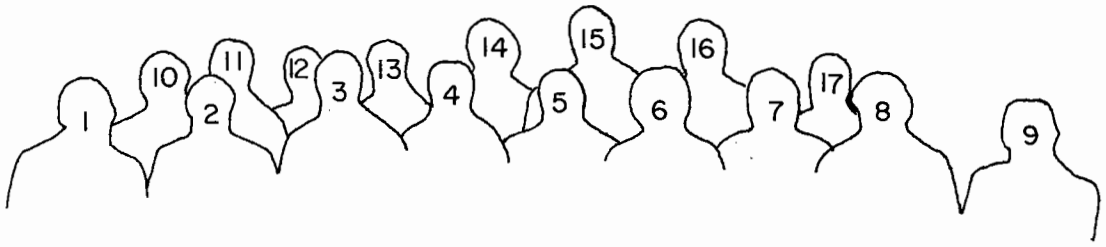


Row 2

1. James Davis
2. Garland Mason
3. Gordon Autry
4. John McLean
5. Gene Amman
6. Bill Ciesla

Row 1

7. David L. Kulhavy
8. Bob Deshon
9. Jim Mitchell
10. Alex Mangini
11. Felton Hastings
12. Paul Buffam
13. Skeeter Werner
14. Dave Parker

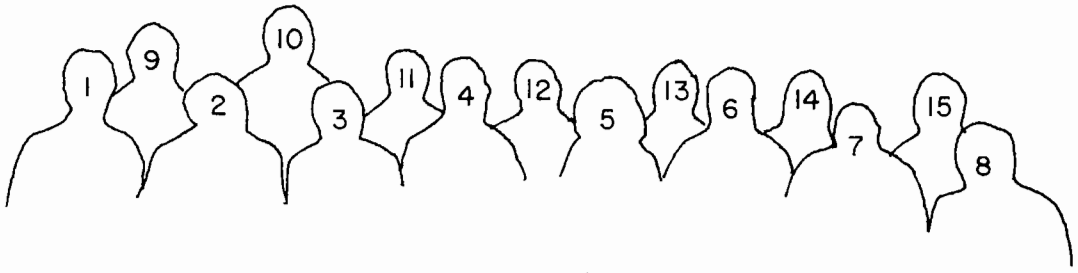


Row 1

1. John Moser
2. Jim Bergen
3. Ed Holsten
4. Dave Holland
5. Larry Stipe
6. José Cola Zanuncio
7. Peter W. Orr
8. Terrence J. Rogers
9. Chuck Dull

Row 2

10. Tom Hofacker
11. Scott Cameron
12. Hubert Meyer
13. Robert Wolfe
14. Ralph Their
15. William Klein
16. Steve Jiracek
17. Roy Beckwith

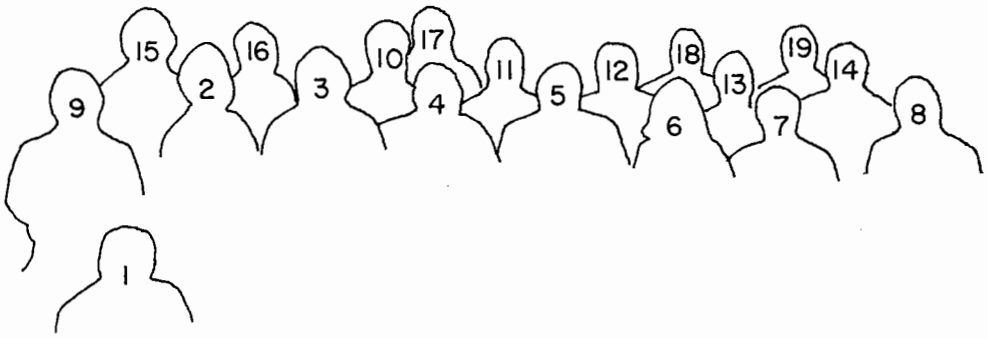


Row 1

1. Jan Conn
2. René Alfaro
3. Jack Schenk
4. Ron Billings
5. Iral Ragenovich
6. Dave Overhulser
7. Tom Koerber
8. Jan Volney

Row 2

9. Tony Smith
10. Dave Leatherman
11. Gary DeBarr
12. Stan Meso
13. Bob Celaya
14. Marilyn Gilmore
15. Jim Colbert



Row 1

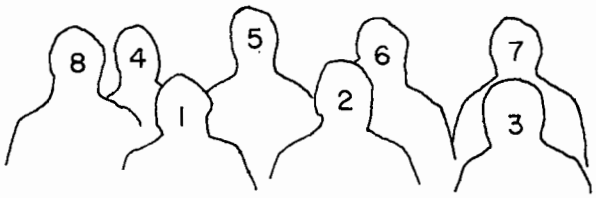
1. J. M. Schmid
2. D. Burnell
3. T. Bible
4. Dick Wong
5. Doug Miller
6. Catherine Stein
7. A.O."Randy"Randall
8. R.D. Frye

Row 2

9. Cliff Brown
10. Barney Dowdle
11. D. Ross Macdonald
12. Bill Ives
13. Bill Waters
14. Bob Stevens

Row 3

15. Gene Lessard
16. Pete Lorio
17. Les Safranyik
18. D. E. Bright
19. C. MacVean



Row 1

1. Dave Bruce
2. Ladd Livingston
3. Emmett T. Wilson

Row 2

4. Mike Wagner
5. Bruce Greco
6. Manfred Mielke

7. Max Ollieu
8. Jerry Beatty

TECHNICAL PROGRAM

Thirtyfirst Annual Western Forest Insect Work Conference

Holiday Inn, El Paso, Texas

March 4 - 6, 1980

Monday, March 3

4:00 - 8:00 p.m.	Registration
8:30 p.m.	Meeting of the Executive Committee

Tuesday, March 4

7:30 a.m.	Registration
8:30 a.m.	Conference opening and Initial Business Meeting Opening Remarks: Don Graham
9:00 a.m.	PANEL: Interdisciplinary Approaches to Problem solving in Forest Entomology. Moderator: Bill Ives Panelists: Walt Cole Max Ollieau Dave Leatherman
10:00	BREAK
10:30 a.m.	CONCURRENT WORKSHOPS:

1. Role of Pheromones in Bark Beetle Management — Ron Billings
2. Population Dynamics of the Western Spruce Budworm — Roy Beckwith
3. Role of the State Forest Etomologist in the Inter-disciplinary Team — Dave Leatherman

12:00 Noon	LUNCH

Tuesday, March 4, Cont'd

1:00 p.m.	CONCURRENT WORKSHOPS:	
	1. Current Trends in Forest Entomology Management	Paul Buffam
	2. Decision Making Tools in Aerial Application of Biological and Chemical Insecticides	Bill Ciesla
	3. Hazard Verification and Implementation Using Aerial Photographs for Southern Pine Beetle	Garland Mason
	4. Modeling in Forest Entomology: Who Needs It:	Jim Colbert
	5. Interdisciplinary Approach to Solving Forest Insect Problems: Mountain Pine Beetle	Walt Cole
2:30 p.m.	BREAK	
3:00 p.m.	CONCURRENT WORKSHOPS:	
	1. Current Research in Seed and Cone Insect Management.	Tom Koerber
	2. Concepts of Integrated Pest Management	Pete Orr
	3. Role of Pheromones in Defoliator Management	Lorne Sower
	4. Recent Investigations Involving the Interaction of Insect and Diseases in Forest Trees	Bill Livingston
	5. Interdisciplinary Approach to Solving Forest Insect Problems: Spruce Budworm.	Max Ollieau
4:30 p.m.	ADJOURN	

Wednesday, March 5

8:30 a.m. — PANEL: Role of Economics in Forest Management

Moderator: Bill Ives
Panelists: Barney Dowdle
Tom Bible
Bob "Cop" Coppersmith

10:00 a.m. — BREAK

10:30 a.m. — GROUP PICTURES

11:00 a.m. — CONCURRENT WORKSHOPS:

1. Meteorological Considerations in Forest Insect Suppression Projects — Bob Ekblad
2. Natural Enemies of Bark Beetles: Potential for Biological Control — Bob Stevens
3. Role of Economics in Forest Management — Barney Dowdle

12:00 Noon — LUNCH

1:00 p.m. — FIELD TRIP

5:00 p.m. — RETURN TO HOLIDAY INN

Thursday, March 6

8:30 a.m. — Final Business Meeting

9:00 a.m. — CONCURRENT WORKSHOPS:

1. Update on Aircraft Guidance Systems — Chuck Dull
2. Collection and Analysis of Entomological Data from Forest Compartment Examination — Dave Holland

Thursday, March 6 - Cont'd

	3. Benefit/Cost Analysis: A Guide or a God?	Tom Bible
	4. Update on CANUSA WEST	Jim Colbert
10:00 a.m.	BREAK	
10:30 a.m.	CONCURRENT WORKSHOPS:	
	1. Silviculture: State of the Art in Forest Entomology - Bark Beetles	Gene Amman
	2. Diversity as a Management Tool	Jan Volney
	3. The Future of Pesticide Use in Canada	A.P. Randall
	4. Use of 70 mm Colour IR Photography in Damage Assessment	Emmett Wilson
12:00 Noon	LUNCH	
1:00 p.m.	CONCURRENT WORKSHOPS:	
	1. Suppression Strategies for Western Spruce Budworm	Doug Parker
	2. Land Use Planning: A Team Approach	Ralph Thier
	3. The Cyclic Nature of Forest Insects: or, Whatever Happened to the Spruce Beetle?	John Schmid
	4. High Altitude Camera Systems for Mapping Forest Insect Damage	Bill Klein
	5. Agricultural Marketing Economics	Bob "Cop" Coppersmith
2:30 p.m.	ADJOURN	

Speakers, Moderators and Panelists - Affiliations

CANADIAN FORESTRY SERVICE
- Ives, Bill; Edmonton, Alta
- Randall, Randy; Sault Ste Marie, Ont.

COLORADO STATE FOREST SERVICE
- Leatherman, Dave; Ft. Collins, CO.

FOREST SERVICE, USDA
- Amman, Gene; Ogden UT
- Beckwith, Roy; Corvallis, OR
- Buffam, Paul; Portland OR
- Ciesla, Bill; Davis, CA
- Colbert, Jim; Partland, OR
- Cole, Walt; Ogden UT
- Dull, Chuck; Doraville, A
- Ekblad, Bob; Missoula, MT
- Graham, Don; Albuquerque, NM
- Holland, Dave; Ogden, UT
- Klein, Bill; Davis CA
- Koerber, Tom; Berkeley, CA
- Ollieau, Max; Ogden, UT
- Orr, Pete; Washington, D.C.
- Parker, Doug; Albuquerque, NM
- Schmid, John; Ft. Collins, CO
- Sower, Lorne; Corvallis, OR
- Stevens, Bob; Ft. Collins, CO
- Thier, Ralph; Boise, ID
- Wilson,Emmett; Albuquerque, NM

NEW MEXICO STATE UNIVERSITY
- Livingston, Bill; Las Cruces, NM
- Coppersmith, Bob; Las Cruces, NM

OREGON STATE UNIVERSITY
- Bible, Tom; Portland, OR

STEPHEN F. AUSTIN UNIVERSITY
- Mason, Garland; Nacogdoches, TX

UNIVERSITY OF CALIFORNIA
- Volney, Jan; Berkeley, CA

UNIVERSITY OF WASHINGTON
- Dowdle, Barney; Seattle, Wash

TEXAS FOREST SERVICE
- Billings, Ron; Lufkin, TX

Minutes of the Executive Committee Meeting

El Paso, March 3, 1980

Chairman Ives called the meeting to order at 9:05 p.m.
Present were:

Bill Ives, chairman
John McLean, councilor
Bill Ciesla, councilor
Eugene Lessard, program chairman
Tony Smith, local arrangements chairman
Les Safranyik, Secretary-Treasurer

Absent were councilor Molly Stock and past chairman Rick Johnsey. Minutes of the 1979 Executive Committee Meeting and the Treasurer's Report were read.

Eugene Lessard reported on changes in the scientific programs, as a result of some prospective workshop moderators not being able to attend the Conference. The Executive recommended that Eugene report these changes to the membership at the Initial Business Meeting.

It was noted that the terms of office of the Chairman, Secretary-Treasurer and councilor John McLean expire at the conclusion of the 1980 Conference. Chairman Ives appointed Bill Ciesla as Nominating Committee Chairman to nominate new candidates for these offices.

The Secretary-Treasurer reported that he updated the membership list during 1979 and will do it again in 1980. The Executive noted that fees for active members should be discussed at the initial business meeting, in light of the high cost of producing the Proceedings.

Tom Koerber noted to the Secretary-Treasurer that Conference funds should be kept in savings accounts instead of chequing accounts, as has been done during the past 5-6 years. The Executive felt that the Secretary-Treasurer should have the option deciding on the type of accounts that best serve the purposes of the Conference. The Executive recommended that the Constitution and By-Laws of the Conference should be printed in the Proceedings every even year for general information to members. The Executive also recommended that both the Constitution and the membership list be printed in reduced size. The Executive wished to restrict the size of workshop summaries to 3 single-spaced, typed pages in order to reduce or maintain the present size of the Proceedings.

Registration fee was set as $20.00 for regular members and $8.00 for student members. The Executive noted that an invitation for the 1982 Conference needs to be called for at the initial business meeting.

The meeting was adjourned at 9:47 p.m.

WESTERN FOREST INSECT WORK CONFERENCE

Minutes of the Initial Business Meeting

March 4, 1980

Chairman Ives called the meeting to order at 8:30 a.m. in the Ballroom of the Holiday Inn, El Paso, Texas. He welcomed the members to El Paso and special welcome was extended to members of the Southern and Eastern Work Conferences.

Minutes of the 1979 Final Business Meeting and the Treasurer's Report were read and approved. The Treasurer reported a balance of $471.95 Canadian at the beginning of the 1980 meeting.

Minutes of the Executive Committee Meeting were read. Concern was expressed by the Executive regarding the length of the Proceedings and printing costs. In the following discussion Gene Amman felt that we print too many unnesessary items in the Proceedings and Walt Cole favoured reducing or eliminating workshop summaries. He also spoke in favour of discouraging citation of Proceedings because this tends to restrict the spirit of workshop discussions. Bob Stevens and Randy Randall spoke in favour of retaining, in a reduced form, the workshop summaries. Bob Stevens moved that the workshop summaries be kept to a single spaced typed page. The motion was seconded by Don Burnell and carried following discussion.

A motion was made by Chairman Ives to assess a $5.00 membership fee of every active member, whether they attended conferences or not. Ladd Livingston and John Schenk pointed out the administrative difficulties that would result from such action. Following further discussion, the motion was withdrawn.

Paul Buffam moved, seconded by John Schenk, that only those members get Proceedings who attended the conference. The membership felt that each year a number of extra copies of the Proceedings should be printed and offered for sale, at cost, to those members who had not attended the Conference. The motion was approved.

A motion was made by John Schenk, seconded by Don Burnell, to hold Conference funds in an account that paid interest. The motion carried following discussion of the tax problems that might be associated with earned interest.

Chairman Ives asked for reports by special committees. Nominating Committee Chairman Bill Ciesla reported that he has asked Walt Cole and John McLean to serve on his committee. Chairman Ives appointed Paul Buffam to serve as Ethical Practices Committee Chairperson since Chairperson Maxine Moyer did not attend the Conference. Eugene Lessard reported on program changes. Invitation was made by Region 1 to hold the 1982 Conference in the Fairmont Hot Springs or Kalispell areas in Montana. The members did not know of any members who passed away during the year.

There being no further business the meeting was adjourned at 9:15 a.m.

TREASURER'S REPORT

Western Forest Insect Work Conference

March 4, 1980

Balance on hand March 6, 1979			$ 691.01	(U.S.)
Received from registration at Boise, Idaho	(+)	$2,995.15	3,686.16	
Expenses of Boise Meeting:	(-)	$1,840.39	1,845.77	
Balance on hand, Aug. 14, 1979:			2,151.25	(Can.)
Received from membership fees	(+)	72.54	2,283.78	
Preparation of 1979 Proceedings	(-)	1,621.89	601.89	
Mailing of 1979 Proceedings	(-)	120.00	481.89	
Bank cheques	(-)	9.94	471.95	
Balance on hand, March 1, 1980:			471.95	(Can.)

PANEL: INTERDISCIPLINARY APPROACHES TO PROBLEM-SOLVING IN FOREST ENTOMOLOGY
Moderator: Bill Ives
Panelists: Walt Cole, Dave Letterman, Max Ollieu

What's new about an interdisciplinary approach to solving forest problems? "We have been doing that for years" is the reply I hear from my FI&DM colleagues. Indeed those statements are true to a point. Certainly we have consulted with a number of individuals representing a variety of disciplines, but the degree of that involvement has expanded significantly in the last few years in the Forest Service with passage of the Resources Planning Act, National Forest Management Act and the new admendments to the National Environmental Policy Act. These acts collectively have dictated that the forest resources manager identify his resources, manage them properly with environmental impacts considered and minimized.

One would think that land managers know what their resources are but resource identification is not always easy. This is especially true now with the ever increasing use of federal lands by an expanding population. Presently, the Forest Service is involved in a massive effort to develop land management plans for every National Forest. These are scheduled to be completed by 1983 and will be updated approximately every 10 years or even sooner if resource values change sufficiently.

Actually, when one looks at resources closely, it becomes apparent that even a current identification may be valid only for that moment. Consider the effect of the Endangered Species Act or the Antiquities Act on apparent resource values. Off road vehicle uses such as snowmobiles and trail bikes or a major mineral or gas strike can change land use dramatically. A combination of resources identified as important today may very well be the wrong mix to meet user demands tomorrow. In reality, resource values are dynamic because people determine values and those values shift and evolve as determined by their needs and desires.

You may be wondering why I have spent time on resource identification. What connection does it have to solving bug problems? We know that defoliators, bark beetles, sucking insects or what have you have damaged trees. We as entomologists know damage when we see it. Consider the dead tops which result from western spruce budworm activity. It is not difficult to attribute the loss to budworm especially when larvae are currently consuming the new foliage and have been for many years. Another example is the tree killed by mountain pine beetle or for you from the south, southern pine beetle. There is no doubt, that the bark beetle caused the mortality and the resultant loss in volume.

Now let's look at the relationship of those insect problems to the resource. Visualize a drainage stocked with Douglas-fir which is currently being considered for timber harvest. The forester expresses his desire to harvest several million board feet of timber from the

drainage. The wildlife specialist points out the need to protect the big game and raptor habitat, the recreation specialist emphasizes the need to protect the visual resource, the hydrogist the water resources, the archeologist the cultural sites and on and on. For site specific resource determination, protection and use the process can be very complicated. Douglas-fir beetle killed trees along the road may not be considered a loss as these may not be cut green for timber because of their esthetic or wildlife value. In this case, the Douglas-fir beetle may have done the landmanager a favor by providing a home for wildlife or if not for wildlife, wood as an energy source sufficiently close to a road that woodcutters can get to it. The beetles may have assisted the forester by killing decadent trees and thereby providing room for young vigorous growth. In this and in other situations, forest insects are doing us favors and our semantic value statements such as "loss and damage "might more appropriately be " gain or improvement". The challenge in this interdisciplinary team approach is to provide the forest resource manager with the proper mix of recommendations regarding forest entomology so that he or she can achieve the values of those particular resources.

Some areas in this Douglas-fir drainage will be dedicated almost exclusively to timber production. For those, we can recommend strategies to help minimize effects of insects and diseases yet maximize fiber production. Many Douglas-fir stands on our National Forests contain a preponderance of old growth so one recommendation is to lower age classes. This will also result in a lowering of average diameter and an increase in spacing. Suggestions such as these if applied can reduce risk to insects and diseases and help keep these stands below culmination of mean annual increment. Recommendations made for areas dedicated to wildlife may include leaving decadent old growth for cavity nesting birds knowing these trees will die in the near future. Some areas require sufficient numbers of large crowned trees to provide thermal cover for big game. Here we will have to help recommend areas and techniques to achieve the desired result for the correct resource mix. As you can see, interdisciplinary teams define resource values by visiting sites and for many sites, this is often the first visit by such a group.

In the past year I have been involved in interdisciplinary teams as the forest entomology representative and when a pathologist was not available, I represented forest pathology as well. On three occasions we considered the timber resource in proposed timber sales, but also examined other resources as part of the total picture. On three other occasions the teams focused on recreation activities. The timber initiated teams met at different times during the 1979 field season to discuss proposed sales. They were flown and/or walked over the site to closely examine tree cover, proposed road systems, hydrology, soils, archeology, wildlife and fire potential. I began to get a better appreciation of the complexity of the land managers job. Potential timber volume can, for instance, very easily turn into a mirage. Road construction may be prohibitive as can helicopter logging. Highly erodible soils such as decomposed granite eliminated a portion of one proposed timber sale. Locate artifacts which indicate an ancient Indian campsite and immediately timber becomes of secondary importance. Landscape architects want timber harvest areas to have the appearance of natural opening or better yet have a forested appearance. These requirements necessitate precise

and comprehensive insect and disease recommendations. Dwarf mistletoe infection can rapidly intensify, particularly in partially cut areas.

Entomology and pathology recommendations were often not well received by the wildlife specialists on the team. Their zeal to protect the big game brought calls for thermal cover, travel corridors, feeding sites, resting sites, calving sites, screening and on and on until little area remained for timber production. In areas dedicated primarily to timber, wildlife considerations still may play an important role in the character and final volume of the sale. I believe many of the recommendations can be included in the selected alternative to conserve resources with realization of some primary resource outputs. Areas within the proposed timber sale can be dedicated to big game and other wildlife needs and still be appropriately managed. After several years, the stands will have changed character with regeneration and growth providing screening, feeding and resting sites in cutover areas. Then, a different mix of resource outputs can be realized from the old sale area. These dynamic processes require flexible management plans which are site specific yet remain applicable over time. The challenge is to provide recommendations which are appropriate to the needs of the area. Such areas contain a variety of resources that in themselves are dynamic.

Involvement in the interdisciplinary teams charged with review of proposed recreation activities gave me some familiarity with the needs of this speciality. We have worked closely with recreation specialists in recognition of green hazardous trees, but this activity addresses only a part of the insect and disease problems. Vegetation management is the critical need I believe for developed recreation areas. Forest insects and diseases commonly build-up and expand in stress situations. Recreation sites often prove ideal habitat for such expansion. Here as elsewhere fire has essentially been eliminated as a tree mortality agent and as an insect and disease controlling force. Who steps in to create tree mortality? You guessed it. Those bread and butter organisms to which we have devoted our lives. Landscape architects and other recreation planners have not had a good track record in consulting entomologists, pathologists, or for that matter silviculturists before recommending the investment of thousands of dollars in site design and construction. Where are those sites located? Of course, where old character trees reside. They put their money on stands which generally are decadent and consequently hazardous with the shortest life expectancy of those available. We need to help recreation planners choose sites with manageable stands that have a reasonable life expectancy. This will require removal of old, decadent trees and treatment of bark beetle and dwarf mistletoe infested individuals. In developed recreation areas it is essential to obtain a variety of tree species and size and age classes to allow more options for management. Single species, evenage stands at or beyond rotation age self destruct with little but, dead standing hazards left. This time bomb can be defused by a series of management actions over time which will reduce mortality from insects and diseases. The land managers then can dictate where, when and how certain trees should be removed to maintain youth, vigor and resultant resistance to insects, diseases and people.

Developed recreation sites are generally managed or perhaps I should say

unmanaged with a philosophy that all living trees are sacred and that the tree cover will be fine without help from man. After all, the trees got there without us didn't they? That's partly true, but without fire to help change stands, we are going to have to work hard to maintain a safe yet "pristine" condition. This is especially difficult with all the people trampling around doing what people do in campgrounds and picnic sites.

Let me relate to you some of the experiences I've had working in this resource area and why I believe our involvement in interdisciplinary team reviews of proposed recreation site activity is worthwhile. The first green hazardous tree inspection in which I participated in the Intermountain Region made me a believer in the need for FI&DM assistance. A pathologist and I reached our first campground early one August morning. At campsite #1 stood a living Douglas-fir which leaned noticeably toward the table and fireplace. Incidently, the campsite was occupied by a family. The tree had a dead top and scattered dead branches in the crown. We thumped the bole with a pulaski handle and it sounded hollow. Increment borings showed no more than 1" of sound wood at three points around the bole. Stress cracks parallel with the bole and large enough to stick your thumb in were evident. We reported this plus other highly hazardous trees to the Ranger. It took five months for the district to remove that tree and then only at our urging.

Elsewhere, I have seen mountain pine beetle infest ten lodgepole in a campground. No action was taken. An additional 25 trees were killed one year later. The third year I visited the site, essentially all lodgepole above 6" DBH were dead. This unregulated drain was not necessary as a registered protective spray is available. The site could have been visited by a landscape architect, silviculturist, entomologist and recreation specialist to chose trees to save and a vegetation management plan prepared for the site. Foresters prepare silvicultural prescriptions for commercial forest stands but don't for higher value developed sites. We have root rot problems in Douglas-fir in developed sites which require special recommendations. Sometimes the Douglas-fir beetle serves as a beneficial insect by infesting the diseased individuals, killing them and forcing their removal. We frequently find dwarf mistletoe in our developed sites. Uncontrolled, this parasite will seriously affect the host species' ability to sustain itself. If we are to have tree cover on our recreation sites we must work closely with a number of specialists to develop the best mix of recommendations for such sites.

The wildlife resource areas present entomologists and pathologists with some special challenges. We have been involved with wildlife problems when working on proposed timber sales and during defoliator projects. Wildlife specialists have recommended that crown cover not be reduced below the 85% level to maintain big game thermal cover. This can easily throw a timer sale into a deficit if much road building is required. There are Douglas-fir stands on these proposed sale areas that are 200-300 years old as well as large acreages of lodepole pine over 100 years old with only 5-15% crown cover and deadfall so thick one cannot walk thru it. I am told that these conditions are hardly ideal for big game. Through management, those situations could have been avoided.

Where big game habitat is needed, we can work with the resource managers, wildlife specialists and silviculturists to help develop the desired habitat and sustain it. We know the insect and disease history of particular forest types. We know what is currently occurring and the probable causes. Our recommendations can, if applied, help alter the effects of insects and diseases so that stands don't self destruct in a short period of time, but rather, at a rate dictated to a large degree by the manager so that resource values can be maintained.

With proper management such stands will provide the desired outputs on a sustained basis and I believe the interdisciplinary team approach will help realize that goal.

Thank You

Panel: ROLE OF THE STATE FOREST ENTOMOLOGIST IN THE INTER-DISCIPLINARY TEAM

Moderator: Dave Leatherman

Our workshop explored the roles individuals in this position do and/or should perform within interdisciplinary teams formed to address forest insect issues. Those attending included land managers, students, university professors, federal researchers, and state entomologists.

Discussion identified that the state forest entomologist should:

--Listen to and assess state and private landowner opinion on forest insect situations.

--Provide input to researchers at all levels (including graduate study) as to which problems affecting his "constituency" warrant attention.

--Interpret and assist in implementation of research results.

--Facilitate interaction between groups that otherwise might not associate to the degree warranted (example: research entomologists and Christmas tree growers).

--Demonstrate research findings and management techniques.

--Sell forest entomology to forest owners and managers.

--Serve in an extension capacity regarding problem detection (including identification), evaluation, suppression and prevention.

--Perform research to the degree encouraged or allowed within the state organization.

WORKSHOP: CURRENT TRENDS IN FOREST ENTOMOLOGY - RESEARCH
Moderator: Ron Billings (substituting for Stan Barras)

This workshop was organized by Stan Barras, who was unable to attend. In his absence, several research workers who had been contacted by Stan prior to the meeting were asked to discuss their current research interests. A total of 18 persons attended the workshop.

John McLean discussed research being conducted at Simon Frazier Univ. and at U.B.C. Pheromones for the ambrosia beetles Gnathotricus sulcatus, G. retusus and Trypodendron lineatum have been isolated, identified and synthesized at SFU; application in survey and suppression have begun. Other studies are being conducted to characterize geographically distinct populations of spruce budworm by means of elemental profiles.

Dave Overhulser discussed Weyerhaeuser's approach to forest insect research, including an attractant-based control and survey system for Eucosma sonomana, cone and seed insects and a new pest of Douglas-fir nursery stock, Chrystoteuchia topiaria. He also summarized a NW Pest Action Council survey which identified high priority concerns among West Coast landmanagers - cone and seed insects and Sitka spruce weevil west of the Cascades and bark beetle prevention on the east side.

Richard Werner (USFS - Fairbanks) summarized his research activities in Alaska which included 1) development of guidelines for reducing spruce beetle attacks, 2) impact of insect defoliation on hardwoods and browse species, 3) monitoring systems for major bark beetle and defoliator pests using behavioral chemicals, 4) registration of an insecticide for control of bark beetles in high value spruce stands and 5) a guide to the identification and control of Alaska forest insect pests.

Bob Deshon discussed current forest entomology research at Colorado State Univ., including studies on insects which attack white fir (western spruce budworm and the needle miner Epinotia meritana); pinyon pine (pitch mass borers, Dioryctria spp., a gelechiid needle miner), ponderosa pine insects (a cecidomyiid gall midge, and mountain pine beetle nematode Neoaplectana carpocapsae.)

Jack Schenk reviewed research in progress at the U. of Idaho, with emphasis on cone and seed insects, the larch casebearer, spruce budworm and mountain pine beetle.

Bill Ives provided a summary of research activities at the Northern Forest Research Center at Edmonton. Emphasis is on the assessment of impact of forest insects, particularly seed and cone insects and plantation insects. Also, the Canadian Forest Insect and Disease Survey will be maintained, with focus on intensive surveys of major pest species.

Finally, Ron Billings mentioned Texas Forest Service research on cone and seed insects in seed orchards and the development of direct controls for southern pine beetle.

WORKSHOP: ROLE OF PHEROMONES IN BARK BEETLE MANAGEMENT
Moderator: Ron Billings

A group of about 35 persons met to informally discuss the potential role of pheromones in management of Dendroctonus bark beetles. The discussion centered around the mountain pine beetle (MPB), Douglas-fir beetle (DFB), spruce beetle (SB) and the southern pine beetle. (SPB)

Manipulation of MPB with attractive pheromones (transverbenol and α-pinene or myrcene) has been more productive in western white pine and ponderosa pine than in lodgepole pine. Inhibitory compounds remain to be identified and synthesized for MPB, but are available for other Dendroctonus species. Gene Amman reviewed the role of attractants for MPB in lodgepole pine; baiting small diameter trees holds more promise than trapping at least until a more potent pheromone is found.

For spruce beetle, attractants (frontalin, seudenol) are effective for purposes of survey (Werner) and for baiting felled or standing trap trees or trees sprayed with insecticides (Safranyik). Wind-fallen trees tend to out-compete synthetic pheromone sources. According to Dave Dyer (in letter to Ron Billings), the use of pheromones in conjunction with insecticide-treated traps or host trees in incipient infestations in high value spruce stands is the most promising single pheromone-based tactic for spruce beetle.

The use of the anti-aggregating pheromone MCH seems to hold promise for reducing the attack density of SB and DFB, but beneficial effects are often negated because attacking females lay more eggs in treated trees (Safranyik). Baiting trap trees with attractants (frontalin and/or seudenol) and scheduling the trees for salvage remains an effective way to reduce DFB populations, but this tactic has yet to be adopted as an operational control procedure (Klein).

Andy Roberts summarized Tom Payne's recent experiments in which individual SPB infestations in Texas and Georgia were treated with inhibitors (endo-brevicomin + verbenone) or attractants (frontalin and α-pinene). The inhibitor applications resulted in displacement of SPB attacking populations with those of Ips avulsus and premature termination of spot spread. More immediate spot disruption was obtained when attractants were deployed on dead host and non-host trees in the inactive zone of expanding infestations. This containment tactic holds promise as a substitute for cut-and-leave - an operational tactic which requires felling trees (Billings). Further evaluations of both pheromone applications are planned for 1980.

In summary, the role synthetic pheromones are to eventually play in management of Dendroctonus species will depend on treatment efficacy, the value of the resource, the beetle and host species involved, the cost of application and the need for direct control applications. At present, of those bark beetle species discussed, pheromones would seem to hold most promise for manipulating the Douglas-fir beetle, spruce beetle and southern pine beetle.

WORKSHOP: POPULATION DYNAMICS OF THE WESTERN SPRUCE BUDWORM

Moderator: Roy C. Beckwith

The workshop was well attended but the time allowed was too short to adequately discuss the subject. The consensus and recommendation of the group was to schedule a longer period for any discussion on population dynamics in the future. Informality was the rule during the session which allowed for a good exchange of ideas among the participants.

To introduce the subject, a discussion centered around survivorship curves and life table analyses. The curves indicate those areas within a generation where mortality factors may be important. Dispersal loss of young larvae from the system appears to be important early in the life history where other factors become more important during the later stages. Bill Waters led a discussion on sampling stressing the importance of accuracy and representativeness as well as precision. For development of life tables and predictive models of population change, the sampling scheme must provide estimates of population density in successive stages and in different locations that are accurate and representative of the same population universe, i.e. without systematic bias due to shifts in the insect population within and between trees. Since the spatial distribution of the spruce budworm differs between life stages, if sampling units less than a whole branch in size are used and/or samples are taken from only one crown level, systematic errors will occur and possibly invalidate survival estimates and projections of population trend.

WORKSHOP: CURRENT TRENDS IN FOREST ENTOMOLOGY-MANAGEMENT
Moderator: Paul Buffam

Discussion revolved around a changing role for Federal and State Forest Entomologists on Forest Insect and Disease Management Staffs. To be effective, today's entomologist must engage in a variety of activities that make forest managers and other decisionmakers more aware of the impacts that insects and diseases can have on their resource management programs and, conversely, the impact that management programs might have on insect and disease occurrences.

Some of the opportunities or activities that we might have that were discussed were:

1. Participate in Silviculturist Certification Program, both as students and instructors.

2. Participate with forest managers in hazard-rating stands.

3. Instruct Inventory and Compartment Exam crews in recognition characteristics of major insects and diseases.

4. Serve on Interdisciplinary Planning Teams.

The present-day forest entomologist must pursue every opportunity to tell the story of the significance of insect damage and methods that can be used to prevent or minimize damage. We should dispense with our normal approach of depending on the silviculturists to represent us in considering insect situations as they affect the management unit to which he is assigned. Instead, we should broaden our contacts to include planners, recreation specialists, wildlife and fisheries biologists, hydrologists, etc., as well as silviculturists. All of these are responsible for resource management recommendations that can either affect insect-caused impact or vice-versa.

The entomologist needs to be a salesman for insect management. An important aspect is to "sell" the public on insect management, so that it's support for prevention and suppression programs can be obtained.

WORKSHOP: DECISION-MAKING TOOLS IN AERIAL APPLICATION OF PESTICIDES

MODERATOR: Bill Ciesla

Aerial spray project directors face two opposing thoughts: (1) covering as much area as possible per day in order to spray a large infestation during the time the target pest is most susceptible; and (2) maintaining quality by providing for even coverage and effectively avoiding sensitive areas. Therefore, they must have appropriate decision making tools to shut a project down during periods of poor weather, equipment malfunction, or when the insect has passed its susceptible stage.

Bob Ekblad (MEDC, Missoula) presented a conceptual framework which places parameters affecting droplet deposition into their proper perspective. These parameters include wind speed, canopy penetration, number of drops, mixing/air stability, and droplets too small to impinge on target. They are graphed to identify an optimum window defined by droplet diameter and wind speed above the canopy.

Ladd Livingston (Idaho Dept. of Public Lands, Coeur d'Alene) described the 1979 Idaho Cooperative Spruce Budworm Project. A total of 140,000 acres were treated. IDPL thought they had tight specifications for contract aircraft, but there were still enough loopholes to permit bidders with antiquated aircraft to bid on the contract.

Bill Ciesla (FIDM/MAG, Davis, CA) described procedures used to calibrate and characterize aircraft for the 1979 Idaho project, problems encountered with establishing effective swath width of TBM's, and evaporation of aqueous sprays. The D-max method of droplet sizing proved to be effective for aqueous sprays. Application of the aqueous tank mix was suspended when relative humidity dropped below the 75 percent to ensure deposition.

A.R. Randall (Canadian Forestry Servce, Sault Ste. Marie) described work in eastern Canada on results of spraying second instar larvae. Advantages of early spraying include cooler temperatures, more stable weather, and the fact that the entire tree rather than the new growth is the spray target.

Workshop was concluded on the note that the best decision criteria may be entirely ineffective if the general public is opposed to pesticide application.

WORKSHOP: RATING SOUTHERN PINE BEETLE STAND SUSCEPTIBILITY

MODERATOR: Garland N. Mason

Foresters have long recognized the potential for preventing pest losses through proper forest management. Past recommendations have been based on experience and repeated observation, but more detailed information was needed to develop effective prevention strategies. Several systems are available to classify stand susceptibility. Two approaches used on mixed ownerships in East Texas and on National Forests in Louisiana were discussed.

In Texas, ten-18,200 acre test blocks were stand mapped using NASA 1/60,000 color infrared photos with small format aerial photo sampling supplement. Six photo identifiable variables were included in the mapping project: basal/acre, total stand height, species composition, crown closure, average tree diameter, and topographic position. Using coded photo-realistic classes and discriminant function analysis, basal area, height, and landform were found to best distinguish infested and non-infested stand conditions. Based on this model, each stand in the 182000 acre test area were rated into hazard classes, the acreage summarized by test block and hazard class. These observations revealed a predominance of land in the moderate class, with relatively few very low and very high hazard stands. Locations of SPB spots (1973-1978 Texas Forest Service records) were overlain (by size and date) frequency was observed to be directly related to habitat availability with most spots occurring in moderate- and few in very low- and very high- hazard categories. However, when all classes were equated to a per 1000 acre basis, the preference for conditions associated with very high hazard stands was outstanding. The trend was more pronounced when total number of controlled trees were considered.

These data were used to derive hazard rating recommendations and guidelines for East Texas. Five-year loss projections (based on 500 1973-1978 spots) were developed to aid in pest management decision making. This system, with loss projections, has been incorporated into a "Texas SPB Hazard Rating Guide" for use with field observation, and existing stand-type maps where appropriate information is available.

Development of a USFS stand hazard classification system for the Kisatchie National Forest in Louisiana using computerized site and stand CISC data (Continuous Inventory of Stand Conditions) has presented new prospects for SPB management. The model is based on data collected from 1393 SPB spots during the two year period 1975-1977. The factors used to assign hazard ratings are forest type, stand conditions class (size and age), site index, operability, and method of harvest. Hazard ratings for each stand is being incorporated into the CISC system for future reference by the forest manager.

This classification method offers application ease and practical utilization, but is suited only for those areas for which data is available. Both hazard rating techniques have been tested only in the area in which the model was developed. A project is currently in progress to validate these models in additional areas, to evaluate application problems, and to develop implementation cost estimates.

WORKSHOP: INTERDISCIPLINARY APPROACH TO SOLVING FOREST INSECT PROBLEMS: Mountain Pine Beetle

Moderator: Walt Cole

In light of the modern day interest and concern by all disciplines, i.e., not only the usual entomological, pathological, etc., but from all resources that could be affected, the participants and this workshop recommend participation from all interested parties (disciplines and resources) from the grass roots to the operational phase of applying solutions to the mountain pine beetle problem(s).

In this context we recognized the following needs and points of action to be taken:

1. Academic level. Emphasis should be placed on coordinated courses involving such resources and disciplines. Basically to make the students aware that they are not an island of effort, but need and should seek involvement from all.

2. Research level. The actual conduct of research, from the study proposal to publication, should also consider and actively involve all disciplines and resources.

3. Application level. In applying and/or testing research results, such will be done with greater ease if all are aware of, or have been brought into the action, early in the game if not at the research proposal level.

4. Evaluation level. An attempt should be made to evaluate not only the immediate interests, but also those of other resources.

5. Strategy level. This is the operational level or end result of problem solving. Such cannot be done without the background and continuous input of the on-the-ground land manager. Sales and acceptance is usually best done if all have been made aware of or informed from the conception of the idea.

The crux of interdisciplinary approach of solving any problem is not only technology transfer but the participation of all from the start to finish. It is mandatory to do so.

WORKSHOP: CURRENT RESEARCH IN SEED AND CONE INSECT MANAGEMENT
Moderator: Thomas Koerber

LeRoy Johnson, Regional Geneticist, reported initial shortages of ponderosa pine seed in some southwestern seed zones. Cone beetles (conophthorus ponderosae) and seed worms (Laspeyresia spp.) are the most prevalent pests, regularily causing heavy seed crop losses. Ponderosa pine seed is currently valued at $35.60 per pound but expenditures up to $200 per pound could be justified to secure badly needed supplies of seed for certain seed zones.

Gary DeBarr reported on cone and seed insect research at the Southeastern Forest Experiment Station. There are over 10,000 acres of seed orchards in production in the southeast. The most prevalent pests are seed bugs (Leptoglossus and Tetyra spp.) and several species of coneworms (Dioryctria spp.) Granular. Carbofuran incorporated in the soil by a power till seeder, is widely used in seed orchards. One spring application provides season-long insect control and results in large increases in seed production. Research there currently includes projects on chemical control of seed bugs and Dioryctria spp., research on Dioryctria spp. and Laspeyresia pheromones, studies of seed bug egg parasites and a new program on hardwood seed insects.

Scott Cameron of the Texas Forest Service reported that Dioryctria spp. and seed bugs are the most destructive insects in Texas seed orchards. Insecticide tests are being conducted to determine the best ways to reduce seed losses.

Dave Overhulser of Weyerhaeuser Co., Centralia, Washington reported on work on insects affecting seed production on noble fir. Seed insects including seed chalcids (Megastigmus spp.) seed maggats (Earomyia sp.) and midges are prevalent. A photo of a midge egg blocking the micropyle of an ovule was shown. This is the first hard evidence of insects reducing seed production by interferring with pollination. Aerial sprays and trunk injections of Orthene reduced insect damage but did not result in increased yield of sound seed.

Mary Ellen Dix sent a report of her research on cone insects of Scotch pine. Carbofuron soil applications were unsuccessful in reducing damage of Dioryctria spp. and seed bugs, but foliar application of Orthene reduced damage from D. disclusa. She also reported that two species of weevils were found in green ash seeds in North Dakota seed orchards.

Dick Reardon of the Insecticide Field Evaluation project at Davis, California is planning a test of systemic insecticides in Idaho to protect Douglas-fir cones from spruce budworm larvae. Second instar spruce budworm invade newly opened cone buds and may completely destroy them in less than a week. Feeding of later instar spruce budworms destroys a large percentage of the seeds in attacked cones.

Pat Shea and Mike Haverty will be conducting tests of insecticides against cone beetles attacking western white pine cones at a seed orchard in Idaho. Preliminary lab data and field screening had identified some promising compounds notably several synthetic pyrethroids.

John Dale of F.I.D.M., Region 5 and Tom Koerber will be conducting large scale field trials of Metasystex for control of Douglas-fir seed and cone insects in California and Oregon.

Preliminary tests of Tom Koerber have resulted in control of cone midges (Contarinia oregonensis) and Douglas-fir cone moth (Barbara colfaxiana).

Jon Volney of the University has initiated a study applying population dynamics theory to a cone crop. This will identify the time and causes of losses in the cone population and presumably identify some opportunities to prevent losses and increase seed yields.

WORKSHOP: CONCEPTS OF INTEGRATED PEST MANAGEMENT

Moderator: Peter W. Orr

AN INTEGRATED PEST MANAGEMENT CONCEPT FOR USDA

Pest management is a component of agriculture and forestry production and marketing systems that seeks to reduce losses through prevention and/or suppression of pest populations. Integrated Pest Management (IPM) encompasses the integration and use of technically and economically feasible and efficient pest management strategies that are implemented through the use of an array of chemical, cultural, genetic, and biological tactics. IPM systems can be implemented in all agricultural, forest, range, and urban ecosystems. IPM methods, systems, and strategies are selected to minimize hazards to human health, to protect or enhance environmental quality, and to achieve needed levels of pest control in an energy-efficient manner.

National objectives for IPM in agriculture include improving production of efficiency of agriculture and forestry, and enhancing agricultural and forest environments.

The Secretary's Memorandum No. 1929 issued on December 12, 1977, stated that, "It is the policy of the U.S. Department of Agriculture to develop, practice, and encourage the use of integrated pest management methods, systems, and strategies that are practical, effective, and energy-efficient." The President's 1979 Message on the Environment of August 2, directed, in part, that "appropriate Federal agencies shall modify as soon as possible their existing pest management research, control, education, and assistance programs, and shall support and adopt IPM strategies whenever practicable."

The purpose of this IPM concept statement is to provide a framework for the essential elements required to implement USDA policy. Research, extension, education, and application activities are crucial functions for the development and implementation of IPM systems. An IPM system involves products of basic and applied research that may lead either directly to control components or provide foundation for systems development and evaluation research. These are disseminated through extension programs or through private sector channels to aid in selection of appropriate control methods and systems, and in their application within strategies of pest prevention, suppression, or eradication. The flow chart and descriptions that follow illustrate IPM as conceived by USDA.

RESEARCH

Basic and Applied Research

Effective pest management draws upon indepth knowledge of pests, hosts, and interactions between and among them. Involved are the development and modification of methods of pest prevention, suppression, and eradication through research. This research involves not only the biological and physical sciences, but also climatology, mathematical modeling and economics. Basic and applied research on control components or methods forms the basis for IPM systems. Basic research in IPM is, in general, research that discovers new vulnerabilities of pests, develops new theories and concepts of pest and host interactions, and establishes fundamental information about various control measures. Applied research on control components in IPM extends knowledge obtained by basic research and develops workable control methods through laboratory and field testing.

Systems Development/Evaluation Research

Integrated pest management requires research on systems that integrate the products of basic and applied research on control components into management strategies. Knowledge is developed on how individual methods complement or conflict with one another. This knowledge permits selection of methods to be used singly or collectively to achieve the desired prevention or control levels. Some of the tools used to develop IPM recommendations are methodologies for cost-benefit analyses of control strategies, predictive mathematical models of pest population dynamics and associated host damage, and automated data storage, processing, and management systems that will efficiently handle data entries.

There is value in dividing IPM systems into two levels. IPM systems level I is the development and application of technology for management of one or more pest species in a single group, such as weeds, insects, or diseases on one or more commodities. IPM systems level II is the development and application of technology for management of several pest groups, such as weeds and insects, or insects and diseases on one or more commodities. Systems development and evaluation research provides the basis for developing the two IPM system levels and defines when each is most appropriate.

ECONOMICS

Economics contributes to the development and utilization of sound methods and strategies for pest control in two basic ways. First, as new technology feasible methods of pest control are developed, analysis is required to estimate their economic feasibility. Second, economic input is essential to the development of integrated strategies for pest control to determine the optimum pest control inputs in agricultural and forest production. Economic variables are the primary decision criteria, as far as producers are concerned.

TECHNOLOGY TRANSFER

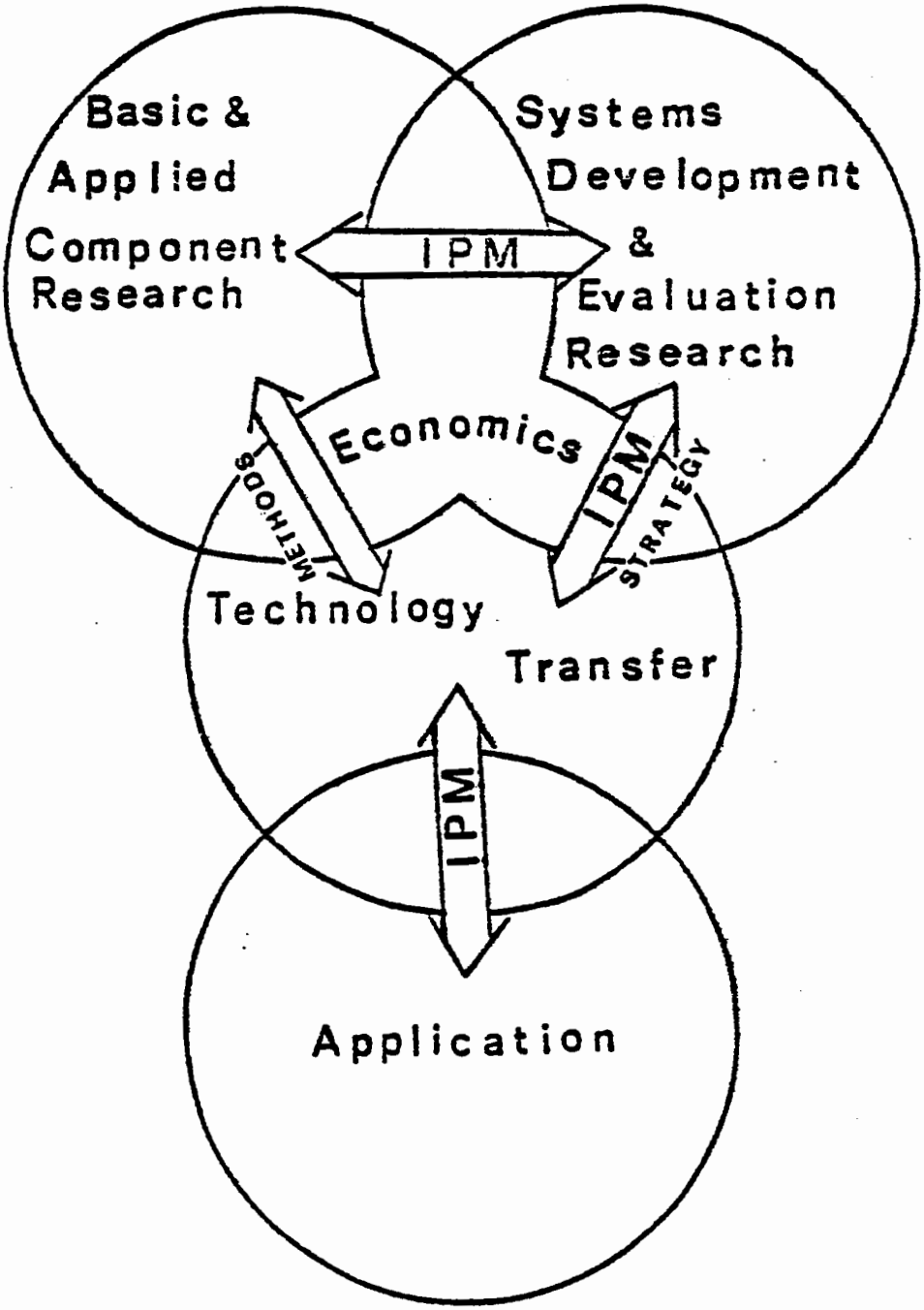
Decisions on when to implement control and what control strategies to use are the central features of IPM. The decision maker must have information on the treatment alternatives and tools necessary for the pest management decisions. Weather, and its impact on both pest and host, can radically affect either prevention or suppression of pests. Complex ecological factors must be carefully considered when any part of the ecosystem is to be manipulated. Thus, a strong extension function is necessary to transfer the technology and techniques of research to the land manager. Essential tools are: (1) pilot projects to determine operational effectiveness of IPM strategies developed by research; (2) demonstration areas to show the effectiveness of IPM strategies; (3) continuing extension programs on an ongoing basis to develop educational materials and provide training for county agents, producers and homeowners, scouts, private consultants, and others who advise land managers and farmers; (4) models that present treatment alternatives; (5) pest sampling and surveillance methods; and (6) mathematical models that predict effects of host and pest population dynamics, climate, soil factors, natural enemies and cultural practices while considering management objectives, economics, and the environment.

APPLICATION

The application phase involves a wide range of ecological, logistic, and managerial considerations. Well-executed prevention, suppression, or eradication programs require closely coordinated interdisciplinary approaches. Often biological estimates are required right up to the day a suppression program is initiated.

Pest/host interaction models based on studies of pest population changes and host impact are used to optimize prevention, suppression, or eradication strategies. Public education and awareness are essential to successful integrated pest management programs. Evaluation of the effectiveness of IPM strategies and their action on the environment is necessary in order to make adjustments and improve future applications.

USDA
PEST MANAGEMENT
RESEARCH AND APPLICATION



WORKSHOP: ROLE OF PHEROMONES IN DEFOLIATOR MANAGEMENT
Moderator: Lonne Sower

Control of Douglas-fir tussock moth and western pine-shoot borer by disruption of the mating communication with synthetic pheromone appears feasible. Tussock moth reproduction was reduced by almost 100 percent where insect densities were low and by about 76 percent in an outbreak population. Dave Overhulser reports western pine shoot borer damage was reduced 70 to 80 percent by aerial applied pheromone in ConRel® fibers or Hercon® flakes. The Weyerhaeuser Company will apply pheromone to several thousand acres of pine in 1980. The controlled release formulations of pine shoot borer pheromone are likely to be registered and available for general use by 1981.

The status of the tussock moth survey, using pheromone-baited traps, was reported by Ladd Livingston. These traps are now being used throughout the West and should indicate increasing of tussock moth populations ahead of actual outbreak conditions. So far, larval surveys in locations where trap captures were high have generally confirmed the trap data. Pheromone traps seem particularly effective in eliminating from consideration locations that do not have potential tussock moth problems.

Status of work on survey trapping for western spruce budworm was reported by Larry Stipe. The objective here is to determine whether trap capture rates can predict next years damage. Tentative results are encouraging and more definitive results are expected over the next year or two.

WORKSHOP: BARK BEETLE - ROOT RELATIONSHIPS
Moderator: Bill Livingston
Panelists: Alex Mangini, Manfred Mielke, Dave Kulhavey.

To clarify the role of root diseases in predisposing trees to bark beetle attack, the amount of diseased roots on live trees and trees recently attacked by bark beetles should be compared. If bark beetles occur on trees with larger amounts of diseased roots, then root diseases probably predispose the tree to bark beetle attack.

For root scolytids (bark beetles that inhabit the roots) to be considered as vectors of root-disease fungi, they should (1) frequently be associated with the disease fungi in diseased roots, (2) have the fungi present on the adult, and (3) be able to introduce the fungi into non-diseased tissue.

To examine trees for root diseases and root scolytids, roots must be exposed. The simplest method is using a pulaski to uncover surface roots up to 1 m from the root collar. More of the root system can be exposed using a pressurized stream of water or explosives.

An example of a root disease is Verticicladiella wagenerii on ponderosa pine. The fungus produces a black streaking in infected roots by growing in the xylem. The black-stained wood is evident when roots are uncovered and the bark removed. In a root cross section, the stain occurs in parallel arcs. Tree to tree spread of the disease is probably by root contacts. Insects may transmit the disease over longer distances.

Hylurgops planirostris, a root scolytid, is an example of a likely insect vector of root-stain fungi. This beetle frequently occurs with stain fungi in roots on dying ponderosa pine in New Mexico. Verticicladiella spp. have been isolated from adult H. planirostris. Pitched-out attacks of H. planirostris are found on non-diseased roots and root collars of live trees.

Eighty percent of the root system must be killed before the fir engraver, Scolytus ventralis, can successfully attack grand fir in northern Idaho. Pseudohylesinus granulatus probably transmit stain fungi to healthy roots of grand fir. Verticicladiella spp. are believed to predispose lodgepole pine to mountain pine beetle (Dendroctonus ponderosae) attack on marshy and steam bottom sites near McCall, Idaho. Hylurgops porosus probably transmit stain fungi between lodgepole pine trees. In New Mexico, Fomitopsis annosa and Verticicladiella spp. may predispose ponderosa pine to attack by the roundheaded pine beetle, Dendroctonus adjunctus.

WORKSHOP: METEOROLOGICAL CONSIDERATIONS IN FOREST INSECT SUPPRESSION PROJECTS
Moderator: Bob Ekblad
Panelist: Jim Bergen

The relations between meteorological conditions and spray drift and effectiveness developed for agricultural practice cannot be directly applied to forest applications. The extreme roughness of the forest surface causes an order of magnitude increase in turbulent diffusion compared to crop surfaces. This is illustrated by data from an experiment in a Douglas-fir stand which show a rapid expansion of the spray cloud with downwind distance; high canopy penetration ratios, and a region of maximum sensitivity to wind speed below 3 mph.

The extreme roughness of the forest surface may also change the aircraft wake pattern from that observed over open fields. This wake flow is apparently effective in moving material through the canopy in the close vicinity of the flight line as indicated by a set of sample profiles of downwind deposition and dosage.

WORKSHOP: NATURAL ENEMIES OF BARK BEETLES: POTENTIAL FOR BIOLOGICAL CONTROL

Moderator: Bob Stevens

This workshop in fact focused more on current activities in the general area of bark beetle biological control than it did in considering "potential". The following topics were presented and discussed:

John Moser, Southeastern Forest Experiment Station, Pineville, Louisiana, showed slides (1) from recent work on Thanasimus dubius versus southern pine beetle, and (2) of various mites he's also encountered. John expressed the notion that we need much more baseline work on the effect of natural enemies before we judge their potential for practical utilization.

Chuck MacVean, Colorado State University, reported on recent work on the nematode Neoaplectana versus mountain pine beetle. The nemas are infective against most beetle stages, but practical problems exist in getting them from the bark surface to the potential host under the bark.

Skeeter Werner, Pacific Northwest Forest Experiment Station, Fairbanks, Alaska, announced his intention to begin studies on spruce beetle natural enemies this coming field season.

John Schmid, Rocky Mountain Forest Experiment Station, Fort Collins, Colorado, discussed cooperative work with biological control specialists in SEA, USDA, involving exchanges of natural enemies with workers in Europe. Work to date in Colorado so far has largely centered on attempts to establish natural enemies in the laboratory.

The moderator reported briefly on a trip to the Soviet Union in the summer of 1979 by Evan Nebeker, Mississippi State University. Evan, accompanied by an entomologist for the SEA lab in Paris, attempted to collect bark beetle natural enemies in several locations in southwestern U.S.S.R..

Doug Miller, Pacific Forest Research Centre, Victoria, mentioned briefly Stu Whitney's work on the fungus Beauvaria, which will hopefully be reported on further in Banff.

WORKSHOP: UPDATE ON AIRCRAFT GUIDANCE SYSTEMS
Moderator: Charles Dull, USDA Forest Service, Doraville, GA
Panelists: Larry Cortland, Teledyne Systems Co., Northridge, CA
Jim Jeffries, Globe Air, Inc., Mesa, AZ
Harry Mitchell, Del Norte Technology, Inc., Euless, TX

Manufacturers and users of aircraft guidance systems discussed the applications of this equipment in pesticide application and insect surveys. Technology in airborne equipment has become very refined to provide accurate positioning and navigational data available through an interface with a navigational computer to conventional and modified aircraft indicators.

The Flying Flagman and Loran-C systems were discussed at length. Characteristics, advantages, and disadvantages of Omega, Inertia, and Decca systems were reviewed. The Flying Flagman electronic guidance system is one of the most accurate positioning systems available. It relies upon two or more line of sight transponders established by the operators to provide coverage in areas up to 100 miles. Loran-C systems depend upon a chain of transmitters established and operated by the U.S. Coast Guard from which it measures the difference in time of arrival of the signals to provide accuracies of less than one quarter of a mile. Once the Loran coordinates have been obtained, return accuracies of 10 to 300 feet are common. The range of a Loran-C transmitter may be up to 1200 miles. About two-thirds of the United States is now within Loran-C coverage.

A left-right steering indicator is interfaced to all guidance systems to provide the pilot guidance along a flight line. The sensitivity of the steering needle can be adjusted. A light bar steering indicator has been developed to allow night time aerial applications when weather conditions are usually most favorable over terrain which will allow a safe operation. Guidance systems can be interfaced to a magnetic tape recording system to allow post application evaluation of the operation to determine the accuracy of delivery to predetermined targets or adherence to flight lines. Pre-stored flight patterns and parallel track steering capabilities are available to allow systematic coverage of an area during aerial surveys, photography, or pesticide/fertilizer application.

Aerial photographic operations conducted by the USDA Forest Service, FIDM, Doraville, Georgia relying upon Loran-C guidance could effectively maintain 15% to 45% sidelap for photographic scales ranging from 1:4000 to 1:30,000. A car equipped with a Loran-C receiver could be accurately located within a 400 foot radius of positions with known locations.

The technology has now advanced to a stage where there appears to be almost unlimited application of such hardware. The cost of the equipment is high and varies with each system depending upon the degree of accuracy required. Organizations frequently involved in operations requiring a precision guidance system may find that the initial expenditures will be offset by savings in reduced flight time and greater quality controls over the service and products provided.

WORKSHOP: COLLECTION AND ANALYSIS OF INSECT AND DISEASE DATA FROM FOREST RESOURCE INVENTORIES

Moderator: Dave Holland

In the past, forest insect and disease problems have been monitored on a local basis as an infestation occurred and not as a systematic Statewide survey. Recent legislative changes affecting management of the forests requires resource managers to obtain better forest resources data. The purpose of this workshop was to discuss the use of existing resource inventory systems for collecting insect and disease data on a systematic Statewide basis.

Renewable Resource Evaluations, Timber Management inventories, State inventories, and compartment examinations were discussed as tools for monitoring forest insect and disease occurrence, distribution, and damage. Collection of insect and disease data during these inventories will strengthen current data bases linking the conditions of the resource with potentially damaging insects and diseases.

Current uses of resource inventories for collecting insect and disease data were reviewed. The following recommendations were suggested to improve this data for use on a national level.

1. Standardize a coding system for insects and diseases compatible with the inventory systems.

2. Monitor only those pests with easily identifiable damage symptoms.

3. Develop a program for analyzing and reporting the results of the inventory.

Utilization of existing inventory systems on a Statewide basis will provide a more thorough data base for managing potential insect and disease problems.

WORKSHOP: COST-BENEFIT ANALYSIS: GUIDE OR GOD?
Moderator: Tom Bible, Department of Economics, Oregon State University.

The workshop was based upon the notion that cost/benefit (C/B) analysis is a management tool rather than a mandate. Hence, the workshop addressed the historical basis of C/B analysis, linked that basis to current FIDM problems, and established common procedural techniques appropriate to FIDM issues.

Historically, C/B analysis was developed to deal with problems where levels of private investment would be lower than optimal from a social perspective. In those cases C/B analysis could provide justification for social investment that would take the form of direct investment or a subsidy for private investors. For FIDM, forest protection is a social investment that might be justified on the basis that private investment would be suboptimal relative to potential social gains. For example, many FIDM programs assume that without federal assistance, state and private decision-makers would make decisions that would be suboptimal in a larger social setting.

Another important issue raised was the use of an appropriate discount rate for the evaluation of costs and benefits of FIDM programs that accrue over time. For FIDM programs the rate of discount is usually given to the analyst. However many studies include more than one discount rate. Specifically, both the U.S.D.A. approved rate of 4% as well as the OMB suggested rate of 10% are evaluated.

Potential problems of interpretation appear when evaluating a project a different discount rates leads to different conclusions. Those cases can leave FIDM in an ambiguous position. However, cases where different decision signals result from the use of different discount rates can often be resolved when the time frame of the decision is considered. In that context, intergenerational problems would suggest a lower discount rate than would intragenerational problems.

The workshop presented a working taxonomy of cost-effectiveness, C/B, and net present value techniques. Cost-effectiveness analysis was identified with problems where multiple techniques for obtaining the same objective were evaluated to determine the most efficient technique. C/B analysis was identified with problems where multiple outcomes, each with its own technique, were evaluated for relative efficiency. Net present value analysis was identified as a technique for resolving certain inconsistencies found in C/B analysis.

The taxonomy developed in the workshop was used to evaluate two recent Environmental Impact Statements (EIS) prepared by the U.S. Forest Service. Those EIS's were the Proposed Cooperative Spruce Budworm Suppression Project: Maine, 1980 prepared by the Northeastern Area Private and State Forestry Division of the U.S. Forest Service, and the Western Spruce Budworm, Amended Final Environmental Statement prepared for the Boise and Payette National Forests State and Private Cooperation in April of 1979.

A full report of the workshop is available from the moderator.

WORKSHOP: SILVICULTURE: STATE OF THE ART IN FOREST ENTOMOLOGY--BARK BEETLES

Moderator: Gene Amman

This workshop was attended by 25 to 30 participants and a good discussion of silvicultural attempts to reduce losses to bark beetles ensued. Time permitted discussing only some of the major species of Dendroctonus. The original objective of the workshop was to discuss attempts at silvicultural control, how well these performed, and modifications needed. However, stand hazard rating systems and philosophy behind silvicultural control frequently crept into the discussion.

Present status of silvicultural control for the following Dendroctonus as presented in the workshop is:

Western Pine Beetle.--The Keen risk classification for ponderosa pine is still being used to identify for logging ponderosa pine of low vigor prior to infestation in Oregon.

Engelmann Spruce Beetle.--Losses to Engelmann spruce beetles can be reduced by removing significant numbers of spruce trees in the larger diameter classes, reducing basal area of the stand, and reducing the proportion of spruce in the stand. Windthrow and breakage occur annually in British Columbia and present a special problem in keeping stands free of Engelmann spruce beetles.

Southern Pine Beetle.--Conditions conducive to southern pine beetle outbreaks are large diameter trees and high basal area stands. Existing guides for thinning southern pines when properly applied should prevent losses to southern pine beetle.

Mountain Pine Beetle.--Silvicultural guides for mountain pine beetle are working well almost everywhere over the range of ponderosa pine. The principal need is to calibrate recommendations published for eastern Oregon by Sartwell to differing stand and site conditions in other portions of the ponderosa pine range.

In lodgepole pine, clearcutting is considered the best silvicultural treatment. If timing of clearcutting can be accomplished before trees reach high risk (large diameter, and over 80 years old) to mountain pine beetle, losses can be reduced. Where the use of clearcutting is limited, diameter limit cuts--removal of all trees 7 or 8 inches d.b.h. and larger--substantially reduced losses to the beetles. Where attempts were made to leave larger trees to avoid large holes in the stands, beetles usually killed such trees within a few years following the partial cuts.

WORKSHOP: DIVERSITY AS A MANAGEMENT TOOL
Moderator: Jan Volney

Our management plans are carried out in ecological communities yet more often than not we concentrate our attention on the dominant population from which value is derived. However, because of the diverse amenities which may be derived from forests, there is a continuing need to consider a larger array of community attributes when management plans are being made. Although some tools are available there is a basic question of theoretical community ecology which must be answered before we shall be in a position to manage communities on principles based on community ecology. This is: what laws govern the composition and structure of multispecies communities?

The species diversity of a community is just one attribute of a community and cannot be used without regard to other community parameters in obtaining useful results to be applied in the management of communities. Much of the evidence that may be used in evaluating the diversity-stability hypothesis must therefore be examined in this light.

Mr. Ives reported on his work in which he examined the data collected by the Canadian Forest Insect and Disease Survey in Manitoba and Saskatchewan between 1945 and 1969. Sufficiently reliable information was obtained on 21 species of defoliators to yield consistent patterns in their population fluctuations when compared to certain weather parameters. Seven of the 21 species reached outbreak proportions somewhere in the area during the period under consideration. For these species the relationship of their fluctuations to weather parameters usually agreed with those obtained by other workers. This further supports the validity of the relationships obtained for the species about which little published information is available. Results of this should be published in the coming year.

The significance of this work to the management of multispecies populations is that it suggests that the relative abundance of the species concerned fluctuates in a manner which is predictable. The predictability in this system may be applied in monitoring longterm changes in this segment of the biota.

Dr. Koerber reported on a situation in which it might be possible to increase forest stand species diversity and thus reduce the intensity of damage caused by the lodgepole needle miner in almost pure stands of lodgepole pine. This stems from observations of trees growing in mixed stands being less severely defoliated than trees growing in pure stands only a few meters away. Such an approach would be feasible on small areas such as campgrounds and other high use areas.

A discussion of the species diversity-stability hypothesis failed to provide an example in which species rich stands growing over extensive areas are killed by a complex of native insects.

WORKSHOP: THE FUTURE OF CHEMICAL PRESTICIDES AND AERIAL SPRAY OPERATIONS FOR FOREST INSECT CONTROL

Moderator: A.P. RANDALL

This workshop was opened with a presentation of a chronological history of aerial spray operations against the spruce budworm, (Choristoneura fumiferana Clem.), during the past decade (1970-1980) in Eastern Canada. The data covered the total epidemic area, the proposed spray area and the actual spray area (millions of acres) that were treated in the provinces of Ontario, Quebec, New Brunswick and Newfoundland. In all cases the infestation area had reached serious epidemic proportions before aerial sprays were considered or applied. During the first half of the decade, the proposed areas and areas treated were approximately the same size, whereas during the latter years of the decade the areas treated were considerably less than the areas requiring control measures. In many cases spraying was completely discontinued in spite of the seriousness of the infestation.

The choice of chemical and biological agents to disrupt the epidemic remained the same but the choice of solvents, co-solvents and emulsifiers were restricted, thus seriously affecting the basic tactic of application technology. Restrictions against the use of No. 2 fuel oil and other high boiling point, low volatile petroleum products has created formulation problems that seriously reduces the efficacy of the pesticide materials and the deposition of spray droplets at the target site. The selection of diluent 585 as the standard diesel fuel oil solvent type with its high colatility and low flash point (135°F) leaves much to be desired as a solvent. This point was well illustrated by Bill Ciesla in his summary of the early Zectran trials in Montana, U.S.A., where deodorized Kerosene (flash point 145°F) was used as the prime solvent on the spray program, with near-tragic results. A slow leak of the spray formulation on the exhaust manifold of the Dakota (DC-3) aircraft during the climb power mode on uphill spraying was ignited by the hot manifold which in turn ignited the spray cloud. The resultant explosion burned portions of the elevator fabric from the aircraft. Fortuitously, sufficient control surface remained on the aircraft to enable the pilot to return to the airport.

A review of all the pertinent factors comprising the tactics of aerial application technology was presented to illustrate the interdependence of all component parts in order to provide the optimum dosage/mortality/spray coverage efficacy of the pesticide.

A single weak-link in the chain such as the physical characteristics of diluent 585 can seriously affect the outcome of the spray program as was evident in the 1978-1979 spray program in Quebec.

The workshop was concluded with a summary by Ross Macdonald on the current forestry situation in the Province of Nova Scotia, (Cape Breton Island), and the effects of recent regulations on aerial spraying restrictions in the Province of New Brunswick. In the non-spray oriented province of Nova Scotia, the destruction of large areas of softwood stands on Cape Breton Island virtually threatened the future of the forest industry. In the Province of New Brunswick a recent anti-spray ruling within a mile of human habitation and along major highways or country roads has removed hundreds of thousands of acres of infested budworm forests and woodlots from the spray program. Many of these areas have suffered severe defoliation and thus are susceptible to total destruction. Of far greater significance, however, is the recent legislation that has placed the control of aerial spray programs under the Ministry of Health, thereby removing the ultimate decision for protection of the forest resource from the Forestry Department.

N.B. Since the presentation of this workshop report, a final blow to aerial application was handed down by a New Brunswick judge in a precedent ruling against Conair Aviation Limited of British Columbia, in favour of a St. Stephen, N.B. family whose daughter fell victim to airplane phobia (profound and pathological fear of low flying aircraft). The ruling (11,750.00) to compensate for family emotional sufferings caused by low flying spray aircraft has caused considerable concern to spray operators with respect to future spray operations.

WORKSHOP: USE OF 70 MM COLOR IR PHOTOGRAPHY IN DAMAGE ASSESSMENT
Moderator: Emmett Wilson
Panelist: Bill Klein

This workshop was planned to acquaint and familiarize the attendees with the use of 70 mm photography as a valuable tool in damage assessment.

Emmett Wilson, Aerial Survey Technician formerly of Region 3, now assigned to Region 8 introduced the 70 mm aerial camera system to the group. Some of the major assets of the system are the availability of all types of film including sophisticated aerial infrared color film which enhances the reflectance from standing dead trees, availibility of such versatile systems as the Hasselblad and Hulcher cameras with up to 500 film frame magazine capability and intervalometer for current overlap for stereo viewing.

Some obstacles to the aerial 70 mm camera system are the lack of commercially available camera mounts for small format cameras. This drawback has been overcome by development of several aerial camera mounts by such groups as Forest Insect and Disease Management, Texas Forest Service, Michigan State University and the Environmental Protection Agency.

Panelist Bill Klein presented an informative overview of the background and development of small format aerial camera systems. Attributes of these systems pointed out by Bill included cost savings, ability of individual units to perform their own photography when time frame and work load were most advantageous to their specific needs.

Bill also informed the group of the development by the Methods Application Group of hand held film viewers for use with 70 mm photography in the field.

WORKSHOP: SUPPRESSION STRATEGIES FOR THE WESTERN SPRUCE BUDWORM
Moderator: Doug Parker

Forest entomologists made a major effort, after the phasing out of DDT in the mid-1960's, to evaluate and register alternative chemicals for use in suppressing western spruce budworm outbreaks. As a result of this effort, we now have two materials that have proven to be effective while not adversely affecting the environment. However, political and economic considerations have limited the use of these chemicals. Today, many forest managers are frustrated in their attempt to protect forests from this destructive insect.

The purpose of this workshop was to discuss research and application work that should be done in the future.

Topics of discussion were:

1. Development of new insecticides--Most participants supported continued development of chemical insecticides.

2. Partial treatment strategy--There was considerable interest concerning this approach. The need for information on larval and adult dispersal in relation to this strategy was emphasized by several people.

3. Spraying early instar larvae--Most people felt that early treatment of the western spruce budworm would not give the same results as achieved with the spruce budworm in eastern North America.

4. Protection of cones--Douglas-fir cones were protected by an early application of carbaryl and acephate in Montana, 1979.

5. B.t. testing--There was strong support for development of this material.

WORKSHOP: LAND USE PLANNING: A TEAM APPROACH
Moderator: R. W. Thier

The National Forest Management Act requires that forest planning be integrated to include the timber, range, fish and wildlife, water, wilderness and recreation resources combined with resource protection activities. By October 1985, the National Forests are to develop an integrated land management plan. The purpose of the workshop was to exchange ideas and discuss the role of entomologists and pathologists in the planning process.

Workshop participants discussed the land management planning direction being pursued by their organizations and the associated problems. Attention was concentrated on planning phases where insect and disease inputs can be made. Identification of forest management concerns received particular emphasis.

In conclusion, the participants realized the frustrations and effects, both positive and negative, of land use planning. Major items developed through discussion were:

1) Land management planning sets the stage for future programs,

2) Early involvement in the planning process is important,

3) Planning efforts will impact contributors' schedules.

WORKSHOP: WHATEVER HAPPENED TO THE SPRUCE BEETLE

Moderator: J. M. Schmid

Spruce beetle infestations have been insignificant in Colorado in recent years. Their insignificance primarily stems from the lack of extensive blowdown in mature stands. Such stands support endemic populations which infest the "normal" annual blowdown of one tree per 5-9 hectares and possibly 1-2 standing trees of large diameter. The beetles do not cause extensive mortality in standing trees until the extensive blowdown occurs and population levels increase in the blowdown before infesting standing material. Safranyik indicated similar conditions were responsible for outbreaks in spruce stands in Canada. He hypothesized that significant infestations had not occurred west of Alberta in recent years because most of the mature spruce had been harvested. He further noted that severe winds not only topple trees but also cause disruption of the connection between soil and roots on standing trees so that such trees may be more susceptible to beetle infestation. For Alaska, Holsten thought windthrow and stand structure were important to outbreaks. Line cutting for seismic exploration has contributed to recent infestations. Unseasonably dry conditions during adult emergence had shortened the time interval when adults emerge, concentrated the attack process into a shorter period and thus enhanced the probability of successful infestation.

WORKSHOP: HIGH ALTITUDE CAMERA SYSTEMS FOR MAPPING FOREST INSECT DAMAGE: SOME APPLICATIONS

MODERATOR: Bill Klein

Approximately 10 persons attended the workshop. The intent of the workshop was to present the methods used and results of several multistage aerial photo surveys using both large-scale 9" x 9" and medium-scale panoramic formats. Bill Klein, FIDM/MAG, outlined the various surveys conducted during the past three years to measure annual mortality of lodgepole and ponderosa pine caused by the mountain pine beetle. Several of the planned participants could not attend because of travel restrictions.

Hubert Meyer, R-1, discussed the 1979 survey to measure annual mortality of lodgepole pine caused by the mountain pine beetle in Montana. This pilot survey was conducted to evaluate the effectiveness of using recently developed multistage sampling survey techniques to measure annual and cumulative mortality on a statewide basis with acceptable statistical reliability, timeliness, and costs.

The 986,000 acres surveyed were stratified into three intensity classes or strata. Initial stratification, from 1979 aerial sketchmap surveys, was followed by large-scale (1:6000) aerial photography, photo interpretation, and ground truth measurements. Photo plots were selected by a systematic random process for each stratum. Ground truth plots were chosen by probability proportional to size (PPS).

Estimates of 1978 attacked lodgepole pine (faders) were 11.6 million, representing 161.4 million cubic feet of volume. Relative sampling errors were 9.8 and 16.5 percent for numbers of faders and volume, respectively. The total number of standing dead trees was 33.4 million with a volume of 517 million cubic feet. The survey required 257 man-hours to complete, at a cost of $43,500.

Bill Klein, using a series of color slides, summarized the pilot survey using reconnaissance scale photography to measure mountain pine beetle damage over a smaller area. In this survey, high elevation, panoramic infrared photography taken from a U-2 aircraft was evaluated to determine its effectiveness in quantifying annual mortality of lodgepole pine caused by the mountain pine beetle in a 520,640-acre outbreak in portions of the Beaverhead and Gallatin National Forests in Montana. A multi-

stage, variable probability design using PPS at three levels was used throughout the survey.

The results suggested that panoramic photography can be effectively used to provide relatively precise estimates of mountain pine beetle-caused annual mortality of lodgepole pine over large areas. Mortality of lodgepole pine in 1977 was estimated at 1,891,510 ± 194,804 trees, and 27,001 M ± 3682 M cubic feet of volume. These estimates differed somewhat from a multistage aerial photo survey also conducted in 1978, the difference ascribed to different areas of coverage. Physical characteristics of this unconventional format were also described, and suggestions for its future use in similar bark beetle damage surveys were recommended.

THIRTY-FIRST ANNUAL WESTERN FOREST INSECT WORK CONFERENCE
Minutes of the Final Business Meeting
March 6, 1980
El Paso, Texas

Chairman Bill Ives called the meeting to order at 8:30 a.m., March 6.

Minutes of the initial business meeting were read. Doug Miller moved to approve the minutes as read, seconded by John Schenk. Carried. The Secretary-Treasurer's Report was read and approved. The Secretary reported that a total of 79 persons registered at the meeting; one of the lowest attendences in the past decade. Chairman Ives called for invitation from the floor for the 1982 Conference. Larry Stipe invited the members to hold the 1982 Conference in Region 1, Montana. Bill Ciesla moved, seconded by John Schenk, to approve the invitation. The invitation was approved.

Chairman Ives called for Committee reports:

Nominating Committee - Chairperson Bill Ciesla nominated the following slate of officers:

Chairperson: Paul Buffam (1980/82)
Secretary-Treasurer: Richard Werner (1980/82)
Councilor: Stu Whitney (1980/83)

There being no new nominations from the floor the nominees were approved by acclamation.

No report was made by the Common Names Committee - Chairman Ives asked the new Secretary-Treasurer to contact Common Names Committee Chairperson T. Torgerson regarding the status and activity of this Committee and report at the 1981 meeting in Banff, Alberta.

Ethical Practices Committee - Chairperson Paul Buffam discussed in detail the outstanding contributions of many members. He was particularly impressed by a member who has "upheld one of the greatest traditions of forest entomologists throughout the world". In a well designed experiment, this person first tested equipment and techniques and being eager to transfer this technology to peers and other potential users, he gave an accomplished demonstration. For this and other performances in Juarez, the Ethical Practices Committee Chairpersonship was won by Dave Holland. Miss El Paso presented the award to Dave. Paul Buffam asked Dave Holland to provide new accoutrements of the office, which wore out during long years of service, for the next meeting. Fay Shon and Maxine Moyer have come up with a suitable award for female Chairpersons.

Bill Ives thanked Gene Lessard for the excellent scientific program and Tony Smith for the fine job he has done with local arrangements. There being no more old business from the floor, outgoing Chairman Ives asked new Chairman Paul Buffam to take over his office. Paul thanked the outgoing chairman and Secretary-Treasurer for the fine job they have done. There being no new business, the meeting was adjourned at 9:00 a.m.

TREASURER'S REPORT

Thirty-first Western Forest Insect Work Conference

El Paso, Texas

Balance on hand March 1, 1980:	$ 471.95 (CAN.)
Income from El Paso, Texas, Conference:	(+)$1879.00 (U.S.)

Expenses of El Paso Conference:

Holiday Inn	(-)$ 627.60 (U.S.)
Adventure World Travel	(-)$ 360.00 (U.S.)

Balance on hand, March 6, 1980: $891.40(U.S.) + $471.95(CAN.)

CONSTITUTION
OF
WESTERN FOREST INSECT WORK CONFERENCE

Article I Name

The name of this organization shall be the Western Forest Insect Work Conference.

Article II Objects

The objects of this organization are (1) to advance the science and practice of forest entomology, (2) to provide a medium of exchange of professional thought, and (3) to serve as a clearing house for technical information on forest insect problems of the western United States and Canada.

Article III Membership

Membership in this organization shall consist of forest entomologists and others interested in the field of professional forest entomology. Official members shall be those who pay registration fees.

Article IV Officers and Duties

The officers of this organization shall be:

(1) A Chairman to act for a period of two meetings, whose duties shall be to call and preside at meetings and to provide leadership in carrying out other functions of this organization.

(2) An Immediate Past Chairman, who shall assume office immediately upon retiring as Chairman without further election; whose duties shall be to fill the chair at any meeting in the absence of the Chairman; to act until the election of a new Chairman.

(3) A Secretary-Treasurer to act for a period of two meetings whose duties shall be to keep a record of membership, business transacted by the organization, funds collected and disbursed and to send out notices and reports. The Secretary-Treasurer is charged with the responsibility of preparing the proceedings for the conference in which his term of office is terminated (amended Feb. 28, 1967, Las Vegas, Nevada).

(4) An Executive Committee of six members, consisting of Chairman, Immediate Past Chairman, Secretary-Treasurer, and three Counsellors elected from the membership. Terms of office for the three Counsellors shall be staggered and for a period of three meetings each. The duties of this Committee shall be to carry out actions authorized by the Conference; to authorize expenditures of funds, and to establish policies and procedures for the purpose of carrying out the functions of the organization. The Conference registration fee will be set by the local Arrangements Committee in consultation with the Secretary-Treasurer and Chairman (amended March 4, 1965, Denver, Colorado).

The officers shall be elected at the Annual Meeting. Their periods of office shall begin at the conclusion of the meeting of their election.

The Chairman shall have the power to appoint members to fill vacancies on the Executive Committee occurring between meetings. The appointment to stand until the conclusion of the next general meeting.

It is the responsibility of a Counsellor, should he be unable to attend an executive meeting, to appoint an alterrnate to attend the executive meeting and to advise the Chairman in writing accordingly. The alternate shall have full voting privileges at the meeting to which he is designated.

Article V Meetings

The objectives of this organization may be reached by holding of at least an annual conference and such other meetings as the Chairman, with the consent of the Executive Committee, may call. The place and date of the annual shall be determined by the Executive Committee after considering any action or recommendation of the conference as a whole. The Secretary-General shall advise members of the date and place of meetings at least three months in advance.

Article VI Proceedings

A record of proceedings of conference shall be maintained and copies provided to members in such form as may be decided as appropriate and feasible by the Executive Committee.

Article VII Amendments

Amendments to the Constitution may be made by a two-thirds vote of the total conference membership attending any annual meeting.

Prepared by Richard Washburn
March 20, 1969.

WESTERN FOREST INSECT WORK CONFERENCE

MEMBERSHIP ROSTER

NOTE: - Members registered at the thirtyfirst (El Paso, Texas) conference are indicated by an *.

- The numerical code to the right of a name indicates most recent conference attendance (or payment of registration fee) within the last 3 years.

- Those members whose names are marked with a + have not attended a conference during the past 3 years but indicated, during the 1980 updating of the membership list, that they wished to stay on the active list.

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