K. Graham

PROCEEDINGS

of the Eighteenth Annual

WESTERN FOREST INSECT WORK CONFERENCE

Las Vegas, Nevada

February 28 - March 3, 1967

Not for Publication

(For information of Conference members only)

Prepared at

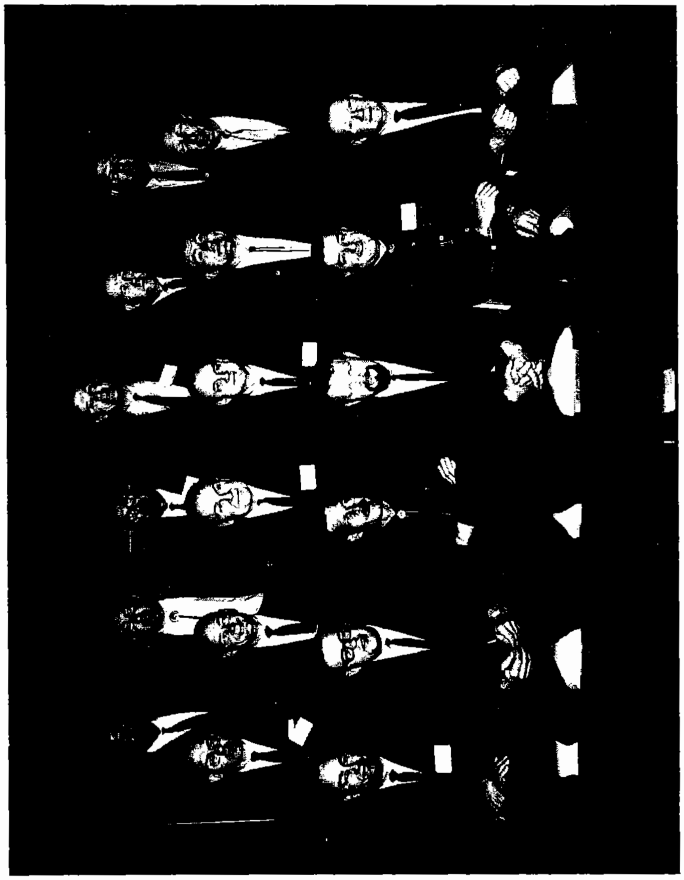
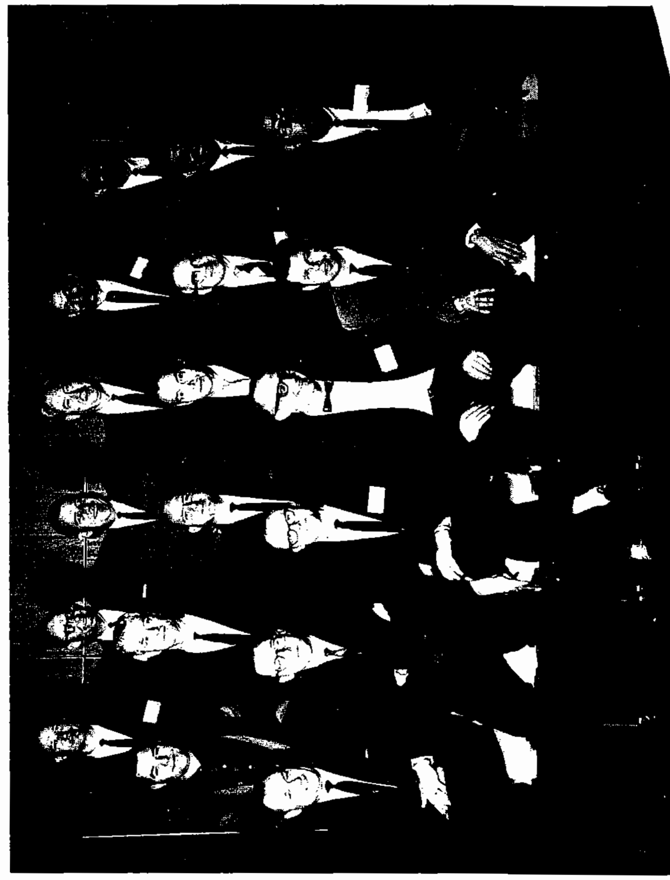
Division of Timber Management
Insect and Disease Control Branch
U. S. Forest Service
Region Four
Ogden, Utah

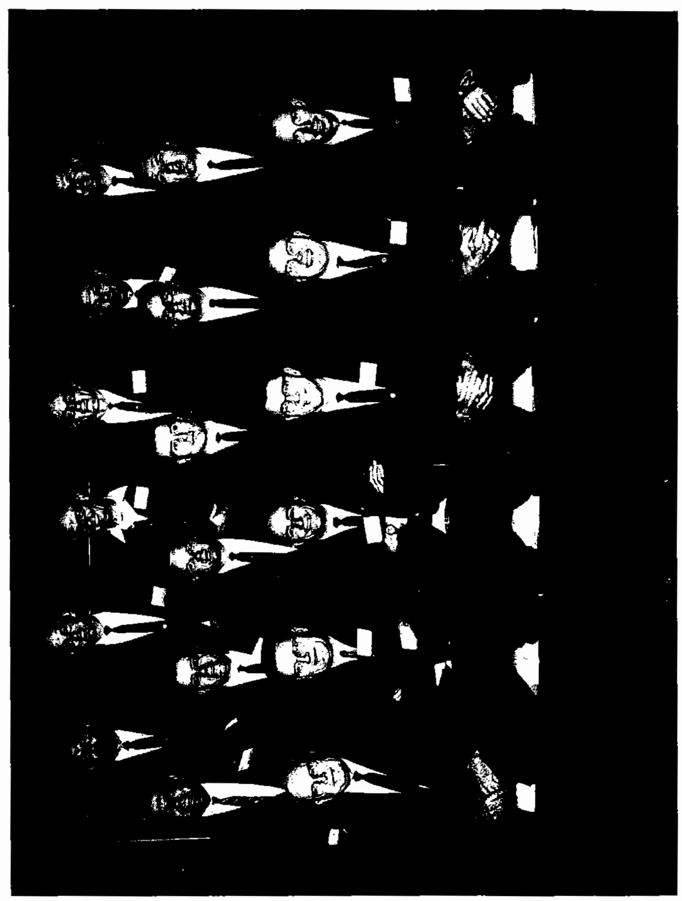
Regional Forester
U.S. Forest Service
Federal Office Building
324 - 25th Street
Ogden, Utah 84401

July 27, 1967

Erratum Sheet

Please correct an error on page 69 in the Proceedings of the 18th Annual Western Forest Insect Work Conference. Dr. Roger Ryan was listed as the author for the paper Donald L. Dahlsten submitted to the Proceedings.



PICTURE A (Upper Left)

Row 1 (L. to R.) Galen Trostle, Harold Flake, Bob Heller, R. F. Anderson, R. E. Tuttle.

Row 2 (L. to R.) R. W. Stark, T. P. Vite, Maxine Minnoch, Harold W. Lembright, Eugene Kenaga, A. D. Moore.

Row 3 (L. to R.) C. J. DeMars, Roger Ryan, John A. Schenk, John W. E. Harris, Al A. Hester, William H. Klein, James Lindsay.

Row 4 (L. to R.) Paul Grossenbach, Arland Valcarce, Gerry Lanier, Hank Thompson, George Downing, Steve Wert.

PICTURE B (Upper Right)

Row 1 (L. to R.) C. E. Brown, D. L. Wood, Howard A. Tripp, Donald L. Dahlsten, Tom F. Ela, Dave McComb.

Row 2 (L. to R.) Donald N. Kinn, Robert P. Harrison, A. T. Larsen, H. J. Haglund, Jule A. Caylor, Scott Tunnock.

Row 3 (L. to R.) Bob Denton, John A. Schmidt, Bill McCambridge, David Dyer, David Crosby, Ken Swain.

PICTURE C (Lower Left)

Row 1 (L. to R.) John R. George, Bob Gustafson, Amel E. Landgraf, Royce Cox, Norm Johnson, Jerry Knopf.

Row 2 (L. to R.) Fred F. Dickison, John B. Simeone, Donn Cahill, Herbert Cerezke, Lloyd Browne, C. H. Schaefer.

Row 3 (L. to R.) S. F. Condrashoff, Russ Mitchell, R. E. Pillmore, Rod Carrow, G. T. Silver, T. R. Torgersen.

PICTURE D (Lower Right)

Row 1 (L. to R.) Bohdan Maksymiuk, Dick Rice, LeRoy N. Kline, Dick Washburn, Mike Atkins, Gary Pitman.

Row 2 (L. to R.) Donald Lucht, John F. Wear, John Pierce, Ken Graham, Boyd Thomas, Imre Otvos.

Row 3 (L. to R.) D. C. Schmiege, James H. Lowe, Jr., L. H. McMullen, C. M. Walker, D. Evans, R. L. Johnsey.

PROCEEDINGS
of the Eighteenth Annual
WESTERN FOREST INSECT WORK CONFERENCE
Las Vegas, Nevada
February 28 - March 3, 1967

EXECUTIVE COMMITTEE (Eighteenth Conference)

R. I. Washburn, Moscow	Chairman
J. M. Kinghorn, Victoria	Immediate Past Chairman
G. C. Trostle, Ogden	Secretary-Treasurer
F. M. Yasinski, Albuquerque	Councilor (1964)
R. E. Stevens, Berkeley	Councilor (1965)
R. E. Stevenson, Calgary	Councilor (1966)

W. H. Klein, Ogden, 1967 — Program Chairman

EXECUTIVE COMMITTEE ELECT

R. I. Washburn, Moscow	Chairman
J. M. Kinghorn, Victoria	Immediate Past Chairman
G. C. Trostle, Ogden	Secretary-Treasurer
R. E. Stevens, Berkeley	Councilor (1965)
R. E. Stevenson, Calgary	Councilor (1966)
J. F. Chansler, Denver	Councilor (1967)

D. L. Wood, Berkeley, 1968 — Program Chairman

Prepared by the Secretary-Treasurer, G. C. Trostle, from summaries submitted by Workshop Leaders. Stenographic services and duplication processing provided by the Insect and Disease Control Branch of the Division of Timber Management, U. S. Forest Service, Region Four.

CONTENTS

Page

EIGHTEENTH ANNUAL WESTERN FOREST INSECT WORK CONFERENCE

February 28 - March 3, 1967

The meeting convened in the Stardust Hotel, Las Vegas, Nevada, at 9:00 a.m. and was opened by Chairman, J. M. Kinghorn.

Mr. Ed Fountain, City Commissioner welcomed the group on behalf of the Mayor of the City.

MINUTES OF THE INITIAL BUSINESS MEETING

The meeting was opened by the Chairman, Dick Washburn, mentioning the members who had retired during the past year. Warren Benedict, Bob Furniss, Bill Mathis and Tom Terrell, and the recent death of retired forest entomologist, H. J. MacAlonie.

The Chairman appointed a nominating committee and charged them to recommend names for one councilor.

The treasurers report was approved as read. The balance on hand was $344.45.

The minutes of the final business meeting for the 17th Conference were read and approved as corrected on a motion by John Shenk.

The minutes of the Executive Committee were read.

A motion by Hester and Shenk was approved which will charge the Secretary-Treasurer with the responsibility of preparing the proceedings for the Conference in which his term of office is terminated.

Committee reports were given by:

1. David Evans for the Common Names.
2. Howard Trip for Ethical Practices.

Ron Stark suggested that future proceedings contain a program.

Stark explained that the final discussion as to the exact location of the 1969 meeting had not yet been made.

A discussion was held as to the possible location of the 1969 meeting. Alaska and Seattle were suggested.

The meeting was adjourned on a motion by Red McComb and Ken Graham at 10:40 a.m.

PROGRAM FOR 18TH WESTERN FOREST INSECT WORK CONFERENCE

Las Vegas, Nevada, February 28 - March 3, 1967

Monday, February 27

	7:00- 9:00 PM	Registration for early arrivals.

Tuesday, February 28

	8:00- 9:00 AM	Registration continued.
	9:00- 9:45	Opening remarks and welcome.
	9:45-10:00	Coffee break.
	10:00-11:00	Business meeting.
I.	11:00-12:00	Keynote address: "Impact of Insects on Western Forests During the Previous Decade", Royce Cornelius, Weyerhauser Company
	12:00- 1:30 PM	Lunch
II.	1:30- 3:00	Plenary session: <u>Gearing Entomology to Forest Management Objectives</u>, Moderator - Norman Johnson, Weyerhauser Company

A. "Reserved Area Management"
George Tourtillot, Supervisor, Wasatch N.F.
B. "High Use Recreation"
Fred Dickerson, National Park Service
C. "Timber Production Areas"
Royce Cox, Potlatch Forest Industries
D. "Entomologists' Dilemma"
Don Lucht, U. S. Forest Service

	3:00- 3:15	Coffee break.
III.	3:15- 5:00	Plenary session: <u>Communication in Forest Entomology</u> Moderator - Tom Silvers, Forest Research Lab., British Columbia

A. "Where's the Pipeline?"
John George, U. S. Forest Service
B. "Communication is a Two-Way Street
Ron Stark

C. "Informing the Public"
Clyde Walker, Pacific SW Forest & Range Exp. Station

D. "Problems of Communication in Forest Entomology
Jack Heikkenen, University of Washington

Wednesday, March 1

IV. 8:30-10:00 AM — Workshops

A. "Management Objectives and Insect Control"
Dwight Hestor, U. S. Forest Service

B. "What is Adequate Control?"
Rick Johnsey, Washington Department of Natural Resources

C. "Evaluation of Bark Beetles"
Bill McCambridge, Rocky Mountain Forest & Range Experiment Station

10:00-10:15 — Coffee Break.

10:15-11:45 — Workshops (continued)

11:45- 1:30 PM — Luncheon with guest speaker.

1:30- 6:00 — Tour of Charleston Mountain Range.

Thursday, March 2

8:30-10:00 AM — Workshop summaries by individual chairmen.

10:00-10:30 — Coffee break and group photo.

V. 10:30-12:00 — Plenary session:
Recent Developments in Forest Insect Control
Moderator - Ken Graham, University of British Columbia

A. "Aerial Spray Applications"
Art Moore, Pacific SW Forest & Range Exp. Sta.

B. "*Bacillus thuringiensis*"
Ralph Anderson, Bioferm Corporation

C. "Sex Attractants"
Dave Wood, University of California

D. "Biological Control"
"Viruses"
Hank Thompson, Pacific NW Forest & Range Exp. Station

E. "Predators of the Balsam Woolly Aphid"
Russ Mitchel, Pacific NW Forest & Range Exp. Station

F. "Biological Control of the Larch Casebearer"
Bob Denton, Intermountain Forest & Range Exp. Station

G. "Problems in Biological Control With Parasites and Predators"
Don Dahlsten, University of California

H. "Chemical Fertilizers to Combat the Balsam Woolly Aphid"
Rod Carrow

12:00- 1:30 PM Lunch.

1:30- 3:00 Continuation of Plenary session:
Recent Developments in Forest Insect Control

VI. 3:00- 5:00 Workshops

A. "Remote Sensing"
Bob Heller, Pacific SW Forest & Range Exp. Station

B. "Artificial Diets"
Harold Flake, U. S. Forest Service

C. "Evaluation of Defoliators"
Dave Crosby, U. S. Forest Service

D. "Use of Parasites in Forest Insect Control"
Bob Denton, Intermountain Forest & Range Exp. Station

E. "Insect Control Equipment"
Don Cahill, Intermountain Forest & Range Exp. Station

F. "ADP and Its Use in Forest Entomology"
C. J. DeMars, Pacific SW Forest & Range Exp. Station

7:00-11:00 Banquet and entertainment

Friday, March 3

8:30- 9:30 AM Workshop summaries.

9:30-9:45 Coffee break.

9:45-12:00 Final business.

12:00- 1:30 PM Lunch

1:30- 5:00 Optional tours of Hoover Dam or Valley of Fire.

IMPACT OF INSECTS ON WESTERN FORESTS DURING THE PREVIOUS DECADE 1/

By

Royce O. Cornelius 2/

When I first saw the subject assigned by your Program Committee, the thought occurred to me that the title could be rephrased to, "Impact of Public Pressures on Western Foresters and Entomologists During the Past Decade." While I do not propose to change from the original assigned title, I note that later today you plan to discuss communications and informing the public. Certainly conservation, pesticides, pollution and recreation have been major political and legislative issues in the past decade. And this has affected everyone here in terms of appropriations, research program objectives, forest pest control projects and timberland management policies.

As all of you here know only too well, public attitudes and public financial support carry great weight at the decision-making level on how public lands and resources will be managed. And public attitudes can materially influence many management practices on privately owned lands either through weight of public opinion or by legislative enactment providing regulatory requirements. Thus while this Conference is concerned with forest insect problems, it is timely to keep our discussions in focus against the broad background of public, political and economic factors affecting forest resource management today.

Looking Back A Decade

Our first American President George Washington once made this observation about looking back: "We ought not to look back unless it is to derive useful lessons from past errors, and for the purpose of profiting by dear bought experience."

With this counsel in mind and in keeping with my program assignment I referred back ten years to your 1957 Western Forest Insect Work Conference Proceedings to see what you were discussing a decade ago. This Conference was held at the Forest Pathology Laboratory in Calgary, Alberta in late March. No doubt a number of you attended that meeting. As program chairman G. R. Hopping outlined what your aims should be as follows:

> "(1) An exchange of work techniques, (2) an integration of work plans and (3) a fraternity of professional forest entomologists. This last implies a free exchange of ideas."

1/ Keynote paper presented at 18th Annual Forest Insect Work Conference, Las Vegas, Nevada, February 28, 1967.

2/ Chief Forest Engineer, Weyerhaeuser Company, Tacoma, Washington.

He stressed the words: exchange, integration, fraternity and ideas - words that may still be applied appropriately to your Conference objectives. The theme of that meeting was a study of environmental factors with particular reference to defoliators. Special panels were devoted to techniques for studying environmental factors and for studying biology and behavior. The Committee on Common Names came up with an impressive list approved by the Conference but not by the Entomological Society of America. This included the balsam woolly aphid, *Chermes piceae* (Ratz), and a number of cone and seed insects. But the insect that impressed me the most on that list was the red-bellied clerid, *Enoclerus sphegus* (Fabr.). That must be a fancy beetle.

Just to jog your memory a bit more, the Conference Secretary for your Eighth Conference in 1957 was A. D. Moore whose address then was 112 Agriculture Hall, University of California, Berkeley. In October 1956 Art conducted a ballot to determine your 1957 preference for a fall or spring meeting. I commend your decision in voting for a spring meeting when you can meet in a place like Las Vegas at this time of the year.

I recall attending your Seventh Conference in Spokane on December 1-3, 1955, when it was cold and snowy and a real contrast to the situation here. Incidentally, then you were still meeting in the same city on the same dates as the Western Forest Disease Work Conference. In Spokane some of us attended parts of both meetings.

The Pesticide Issue

Anyway, so much for the exploration back into Conference history. Now let's take a look at some of the developments that have affected your and my activities since that time. Of the many events that took place in the past decade the pesticide issue and the political hassles that resulted had the greatest impact on forest pest control. This was the era of Rachel Carson and Silent Spring, of charge and counter charge, of Congressional hearings, of creation of the Federal Committee on Pest Control and of many other developments. Many of us here were deeply involved throughout this period in writing articles, making speeches and presenting testimony. And the insects didn't quit defoliating trees and killing timber just because human beings across the country were having arguments about pesticide use.

Some of us were unfortunate enough to be involved in undertaking forest insect control aerial spraying projects right at the time of the controversy. You may recall that in Southwest Washington in 1963 the Willapa Hemlock Looper Control Project was completed successfully and a documentary film OPERATION WHIP was produced to tell the story. The biological impact of the project was carefully evaluated, including followup studies conducted for a year after the spraying. Some 22 public and private organizations were involved. These studies were summarized in a Status Report issued in May 1964 and in a 1966 Supplement to the Status Report issued in January 1966. These are available from the Washington Department of Natural Resources.

The next year in Oregon similar procedures were applied on the Tussock Moth Control Project near Burns. In these and other control projects of that period throughout the West, including the Salmon Spruce Budworm Aerial Spray Project in Idaho, a tremendous job was done, not only in planning and execution of the projects, but also in telling the story to the public and in documenting the biological impact of the project on related resources. I commend you men here who provided the technical know-how and the research talents to accomplish these projects successfully under very adverse circumstances. That you did an excellent job is exemplified by the fact that the Ribicoff Senate Subcommittee concluded that human health hazards are not now significant enough to warrant drastic curbs on the use of pesticides. Their report, Pesticides and Public Policy, released in July 1966, presented the results of two years' of study of pesticides and numerous Congressional hearings. If you haven't read this report you will find it to be an interesting document for study.

Looking back in retrospect at the pesticide hassle I feel that the Pest Action Councils, the Western Forest Pest Committee, Western Forestry and Conservation Association and many individual entomologists and foresters made an outstanding and effective effort in meeting this issue head-on, in successfully warding off unnecessary regulation and in retaining pesticides in our kit of tools for battling forest pests. Federal, state and private forest entomologists worked closer together than ever before. And from it came some good results in terms of expanded research facilities and programs, which are producing some of the new knowledge and techniques that you will be discussing during this Conference.

Research Philosophy

At this point I want to touch on a bit of philosophy with regard to research. The Northwest Forest Pest Action Council has maintained close liaison with the two federal agencies most closely associated with forest pest matters. These are the Forest Service and the Bureau of Sports Fisheries and Wildlife. To exchange respective viewpoints and encourage continued cooperative efforts, the Council has arranged meetings with key administrators and research personnel of these agencies. One of these meetings in 1964 was in Denver and included a visit to the Denver Wildlife Research Laboratory.

Recommendations developed from these meetings of the Council emphasized the need for positively oriented research. Too much research had been focused on proving what was wrong with pesticides, particularly DDT. We expressed the need for positive research aimed at providing practical guidelines for forest pest control with adequate consideration given to protecting forest-related resources such as fish, wildlife and water. In effect we said you provide the tools and we'll put them into practice. Another recommendation stressed the need for communication between research agencies working on closely related problems such as pesticides. We were pleased that favorable cooperative action resulted in response to most of our recommendations.

Every research organization must periodically reappraise its goals, programs and accomplishments. This includes reappraising the balance being achieved between essential basic research and applied research. In forest entomology there is a continuing need to orient research toward practical applications. And forest entomologists need to work closely with forest managers in making forest practice decisions and in providing practical guidelines to minimize mortality losses caused by forest insects. I urge you not to neglect basic research, but at the same time try to keep your research efforts positively oriented toward practical applications. I want to especially commend the Canadians for the emphasis given to insect and disease research in their overall forestry research efforts.

Logging - A Valuable Pest Control Tool

Although aerial forest spraying comes to many people's minds first when forest insect control is mentioned, we should never overlook the tremendous strides that have been made in using logging not only to minimize forest insect losses but also to reduce deterioration of insect killed trees. I feel that we owe loggers a real tribute. At the same time we need to examine how we can be more helpful to them by providing additional practical guidelines. Perhaps the outstanding example of providing practical guidelines is the excellent work by Paul Keen and others in developing tree classes and marking rules for ponderosa pine. Millions of board feet of timber losses to bark beetles have been prevented by application of these marking rules ahead of logging. Marking rules in Weyerhaeuser pine operations have been further refined to include research recommendations on dwarf mistletoe control and on desirable levels of cut as determined by soils-vegetation surveys.

To fully appreciate the value of these marking rules and sanitation logging as forest management tools one needs to occasionally visit a reserved natural area. I recall such an area on the Metolius River near Sisters, Oregon. This mature ponderosa pine stand has been riddled by severe mortality. Snags, dead trees and windfalls throughout the stand are a depressing sight as compared to adjacent managed stands. But this vivid comparison illustrates effectively the progress that forest entomologists have made possible through research.

If I weren't attending this Conference today, I would be working on woods operating plans and on operating policies and guidelines for Weyerhaeuser woods operations. If you will bear with me, I'll talk about Weyerhaeuser timberland operations for a few minutes to illustrate how we put forest entomology knowledge into practical application.

Weyerhaeuser manages 3,600,000 acres of fee ownership of which 2,800,000 acres is in seven major operating areas in the Northwest. The balance of the ownership is in two operating areas in the South and one in eastern Canada and the Northeast. Each area supplies raw material to a complex of integrated manufacturing plants.

For each area a woods operating plan is prepared, which includes maps with overlays and corresponding tabular summaries. The base map shows timber stand priorities for all Company ownership and delineates by color the stands that should be logged first based on timber stand condition. Normally these also would be the stands most susceptible to insect attack and suffering heaviest mortality.

Next is an overlay on which all casualty timber is shown in bright red. This includes blowdown and insect killed timber. Our source for this is aerial surveys made three times each year - early spring for blowdown and slides, summer for bark beetles and fall for other insects and early bark beetle fades. This casualty timber is mapped on large scale aerial photos, which are left at the operating area just as soon as the survey is completed. As many casualty timber areas as time permits are checked on the ground jointly by the aerial surveyor and the area forestry staff. Also we fly our managers and key woods supervisors over the area so they will be familiar with current problems and casualty timber locations. Thus when casualty timber is shown on the woods operating plan map everyone knows why it is there and that it is No. 1 priority to recover if economically feasible. And if area personnel classify certain casualty timber as uneconomic, they must be ready to justify that classification.

The top overlay is the annual plan for the woods operation. All clearcut settings and partial cuts for thinnings, sanitation and mortality salvage are shown. The volumes to be produced by volume, grade and species are projected from the cutting areas outlined in the plan. Road construction planned is shown for the current year and by projections for two years in advance. Roads on the map are keyed by stations to the budgeted dollars for road construction. It is a simple matter by examining this top overlay to determine if the logging and road construction planned for the year are geared to casualty timber salvage and to the highest timber stand priority.

The next step is to develop the woods equipment budget and to select equipment and logging systems that will meet the production needs scheduled in the woods operating plan. Some outstanding developments

Logging Roads

It is encouraging to be able to report that by next year we'll have our Klamath Falls Area completely roaded aside from some spurs that can be constructed rapidly when needed. Thus, here is one large industrial forest property in the West, where we can soon say every tree there is like merchandise on the shelf. Whenever the pine beetles strike anywhere, or any catastrophe occurs, we'll be able to take immediate sanitation-salvage action. We have made economic evaluation appraisals of advance roading in our Douglas-fir areas and each year are stepping up our road construction in these areas. There the Douglas-fir beetle and balsam woolly aphid are current major causes of mortality losses and are an important factor in justifying advance roading in any economic analysis.

The Rocky Mountains

Now let's turn from this account of blending entomological knowledge into operational planning and take a look at where we are today. Last summer with my 16 year old son I packed into the San Juan Primitive Area in Southwestern Colorado. The summer before I drove extensively in the Colorado Rockies including visits to Creede, Silverton, Aspen, Leadville, Vail and other scenic areas. I was appalled at the volume of Engelmann spruce killed by the Engelmann spruce beetle. Even when I went cross country I was glad I had brought my caulked boots from the Northwest to keep my footing while walking across windthrown and down trees. Utilization plants, particularly pulp mills, are essential to solving this problem in the Rocky Mountains. Water supply, pollution, water quality, present pulp manufacturing processes, access roads and economics appear to stand in the way of an early solution of this problem. But in the interests of our economy everyone concerned must work toward a solution soon.

Western Pine Region

In the Western Pine Region the Mountain Pine Beetle is on the rampage in young ponderosa pine and in lodgepole pine stands. To the best of my knowledge forest entomologists are not optimistic about the outcome. Here again it is a matter of economics and utilization plant capacity capable of economically utilizing the available material if timberland management were applied to these stands. Nonetheless, in spite of all the problems that may be recited I am still optimistic. Early this month I was in our operations in North Carolina and watched a mechanized shear working on the front of a small crawler tractor. This was cutting trees up to 16 inches diameter at the rate of two trees a minute. These were being pulled to the landing in tree lengths by rubber tired skidders with integral grapples. Thus some of the woods production problems and economics on favorable topography are being resolved through mechanization. And as the demands of our economy for chips and quality wood fiber expands, utilization facilities will be developed for this material. I'll agree with you that except where utilization plants exist capable of using the material and where roads provide prompt access as at Klamath Falls, there is no immediate solution except for Mother Nature to exercise her ruthless silvicultural selection system with beetles as the tree executioners.

Parks and Reserved Areas

One other aspect of timber losses to insects will always bother me, and that is the extensive reserve timber areas in national parks, wilderness and other reserves. In the fall of 1954 Bob Furniss and I drove through Yellowstone and the Grand Tetons in September on the way to the Annual SAF meeting in Denver. It was an entomologist's paradise, especially the Grand Tetons. The Mountain Pine Beetle was taking its toll. Red topped trees were everywhere. The Park Service was spending large sums treating infested trees in a direct control program, particularly near heavy use areas. They knew this was a futile delaying action and did not solve the problem. Only an aggressive timber management program with careful selective logging could create a healthy forest resistance to insect infestation. I have to presume that the Park Service will go on forever fighting their uphill ecological battle with bark beetles and decadent forests. Somehow in a progressive country such as ours there should be a better and more realistic solution.

When our distinguished Secretary of Interior Stewart Udall proclaimed that DDT would never again be used on Department of Interior lands, I silently prayed that all the forest defoliators in the western United States would suddenly converge on the real estate under his administration. Fortunately he has a closer alliance with the Almightly than I do or many of you here would have received special assignments to help the Department of the Interior with their forest pest control problems and to do this without the benefit of DDT. And this was while Art Moore was still trying to get his new chemical pressure cooker at Berkeley staffed and up to a full head of steam. Nonetheless, I wish that you, as the most knowledgeable group of forest entomologists assembled anywhere in the United States, would explain to me why all the hemlock looper epidemics that have occurred in the Northwest have been principally on private forest lands and not in the Olympic National Park? And why when Hurricane Frieda swept through the Northwest on October 12, 1962, did it miss the national parks and instead devastate private and state ownership? Obviously our Secretary of Interior leads a charmed life.

Silvicultural Limitations

Now for one more problem that bothers me, and this one has a more practical aspect. In the Pacific Northwest we still have far too much productive land that is inadequately stocked with conifers. Most of these are brushy areas and ideal habitat for rabbits, mountain beaver and other animals. On many of the areas along the coast Sitka spruce would be a desirable species for use on these rehabilitation areas. But entomologists have never developed an easy practical solution for control of the Sitka Spruce Weevil. In other locations on severe sites the western white pine will outproduce any other Northwest species. But the combination of blister rust and Mountain Pine Beetle removes this species from the silviculturist's kit of tools. Then there is the European Pine Shoot Moth that poses a real threat to the Ponderosa Pine Region, and for which present quarantines are merely valiant delaying actions. Thus while I know all of you are working on important problems, don't rest on your laurels. And without question as we move toward more intensive young stand management, the situation will be like one of my Southern friends recounted, "We've got problems we haven't even bothered to talk about yet." Also I have another friend, a silviculturist in the Northwest, who refers to entomology as "negative silviculture." That's a challenge for all of you to overcome.

Changing Leadership

It is timely as we think again of the past decade that I was supposed to analyze to realize that our leadership is changing and that added responsibilities will fall on many of your shoulders soon or within the next few years by virtue of retirements and personnel changes. Within the last few months we have lost some stalwart leaders and spokesmen. Warren "Bene" Benedict and Bob Furniss retired at year end. Washington State Forester, Mike Webster, a faithful worker on the European Pine Shoot Moth problem, passed away in January. And even our fearless leader of the Northwest Forest Pest Action Council, Dr. Ernest L. Kolbe, is in his last term as Chairman prior to retirement. I know that you could name others. So we must continually develop new leadership to meet new challenges as they arise.

Conflicts of Interest

Before I close let's take one more look at the broad and changing background within which we must work on forest insect problems. In a recent paper Mr. Dewitt "Swede" Nelson, former Director of the Resources Department of California and now Guest Lecturer at Iowa State University, had this to say about the conflicts of interest encountered today in resource management: "With more leisure time, more money and greater mobility for an exploding population there is need to provide more recreation areas, to set aside choice and unique seashores and wilderness areas, and to provide open space in and around areas of population density. There is also need to produce more of the projects of our natural resources to meet the day to day consumption demands of the people. We therefore, find ourselves in a paradoxical situation with a multitude of built-in conflicts of interests and objectives.

"So, these demands for products conflict with demands for services and create political issues of use versus preservation, of mass recreation versus wilderness, of open space versus subdivisions, and of industrialization versus water quality control. - - - -

"Farming, grazing and logging can impinge on fish and wildlife, likewise heavy wildlife populations can be damaging to agriculture and forest crops. How one resource is managed or mismanaged can produce either detrimental or beneficial effects on one or more other resources. - - - - Resource managers must learn to deal with the whole property and all its resources."

Future Trends

Growth in our 11 western states from 1955 to 1965 was nearly four times the national average. Thus we must look forward in our planning to more congested populations and to the impact on natural resources.

Today in the United States citizens of age 25 and under nearly outnumber their elders; by 1970, there will be 100 million in that age bracket. Over half our present population is under 28 years of age. Most of these young people grew up in urban surroundings, not on the farm and in forest or rural areas. And the one man-one vote rule places the legislative decisions now and even more in the future in the heavily populated areas. Thus in forest entomology as in all phases of future resource management there is a real job to be done in communications - in gaining public understanding of what we're doing and why. Let's do a good job of winning the battle with forest insects. Never hesitate to let people know about your progress and good accomplishments.

The December issue of the Washington DNR Totem included a pertinent statement, "The true measure of achievement is that what we do today will be of lasting benefit tomorrow." I feel that the forest resources you forest entomologists have saved through your good efforts qualifies fully as a true measure of achievement.

It's been fun being with you. Best wishes for a most successful Conference.

RESERVED AREA MANAGEMENT

By

George Tourtillott

It is a real pleasure for me to participate in this Work Conference and I might add--most timely. It is also a pleasure to renew old acquaintances; people that I have worked with in the past and to meet new ones with whom I hope to work in the future.

The agenda for this Conference covers many items and areas that are of concern to me as an administrator, subjects that are designed to develop the new ideas and expertise needed to meet our goals.

As a member of this panel, I have been assigned the topic: "Reserved Area Management." To most of us, this brings to mind the areas now included in the National Wilderness Preservation System. It would also include areas that are now classified as Primitive Areas in the National Forest System, many of which are currently being studied for possible inclusion into the Wilderness System. In this context, we would also be talking about other areas that may be put into the Wilderness System that are under the jurisdiction of the Park Service, Fish and Wildlife Service and others. In addition, there might be other areas that may fall into this category now classified as scenic, roadless, natural, and others.

For the purpose of this discussion, I am going to be talking about wilderness and primitive areas, primarily. But, before we go further, I think we should take a few minutes and discuss the sideboards under which we are and will be operating; namely, the National Wilderness Preservation Act of September 3, 1964 (PL 88-577). Culminated in the passage of this Act, was nine years of work by many, many groups and individuals pulling and tugging to develop a workable law. Manifest in this Act is one of the greatest compromises that has come out of Congress in many years. A paradox. A set of diametrically opposed philosophies have been handed the land manager. So that I am not misunderstood, let me say here that I am not knocking the Act, but I am saying that it will take all of our collective imagination and ingenuity to administer the Act and the Regulations of the Secretary of Agriculture signed last May.

Congress defined Wilderness as follows: "A Wilderness, in contrast with those areas where man and his won works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act; an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

Pursuant to this national policy, the Forest Service objectives in wilderness area management are:

1. Maintain an enduring system of high-quality wilderness.

2. Perpetuate and, where necessary, restore those values dependent upon a wilderness environment.

3. Provide, to the extent consistent with items 1 and 2, opportunities for public use, enjoyment, and understanding of wilderness, and the unique experience dependent upon a wilderness setting.

4. Maintain the plants and animals indigenous to the area.

5. Accommodate and administer those uses or activities which are of the type generally prohibited by the Act, but which are specifically excepted by the Act, in such a manner as to minimize their lasting impact on wilderness environments and values and so that the end result will provide optimum total benefits to the American people.

6. Maintain stable watersheds.

Now let's consider the policies developed by the Forest Service to achieve these objectives:

1. Each National Forest wilderness will be managed and the use of all its resources will be administered so as to promote, perpetuate, or where necessary, restore its wilderness character and values.

2. The scope and variety of environmental conditions, unique values, patterns of use, local customs, and traditional public attitudes which characterize individual National Forest wildernesses will be recognized. As appropriate and consistent with the aims and purposes of the Wilderness Act, such varying characteristics and differences will be reflected in individual management plans which will be prepared for each National Forest wilderness as provided in standard National Forest planning instructions.

3. Both climax and successional biotic communities will be recognized as natural and desirable phenomenons. Ecological processes will be permitted to operate naturally.

4. No buildings will be constructed within a wilderness to provide visitor information services.

5. Active and positive management measures will be taken to perpetuate or restore the wilderness characteristics or unique values of National Forest wilderness, and positive measures will be taken to prevent development of sanitation and pollution problems.

6. No commercial enterprises, no roads, no uses of motorized vehicles or motorized equipment will be allowed except,

   a. In bona fide emergencies

   b. When an essential administrative activity cannot be accomplished by primitive methods

   c. If it is necessary to continue an essential program that was firmly established before the area was made a part of the wilderness system

   d. Subject to the restrictions the Chief deems desirable, the use of aircraft and motor boats may continue in those units where they were firmly established prior to the Wilderness Act.

   In these cases, the Forest Service will abide by the regulations in administering wildernesses. Our trail crews will hike, our lookouts will be supplied by old fashioned ground transportation such as pack animals, and only in rare cases of management necessity, will the use of mechanical equipment be authorized. In adhering to these Wilderness Management Policies, it is recognized that it will cost more to do certain jobs. In other cases, the cost will be less, but perhaps less conveniently accomplished.

   As you can imagine it was difficult to draw firm lines. But firm lines must be drawn and adhered to by all of our people in wilderness administration as well as packers, outfitters, and other users of wilderness and primitive areas. If exceptions are made too easily, they soon will become the rule and our wilderness will be gone.

7. Existing activities prohibited by the Wilderness Act and regulations of the Secretary of Agriculture and existing improvements constructed for recreation, wildlife, administration,

or any other purposes, which are not essential to administration, protection, or use of wilderness, will be scheduled for removal as soon as reasonable and practicable.

8. Resource uses and activities which are of the type generally prohibited by the Wilderness Act, but which are specifically excepted by that Act or subsequent established legislation, will be permitted and managed under multiple use principles. However, wilderness values will dominate in reaching management decisions. Activities permitted by the Wilderness Act are:

   a. Grazing of domestic livestock. No roads will be allowed. Additional improvements or structures may be built only when necessary to provide management which will protect wilderness values.

   b. Access to valid mining claims.

   c. Access to state and private land must be by routes and modes of travel approved by the Forest Service and meet the specific need.

   d. Mining, mineral leases, and mineral permits.

   e. Gathering information about resources must be carried out in a manner compatible with the preservation of the wilderness environment.

   f. Water use structures and related facilities with approval of the President.

   Therein lies the paradox and the managers dilemma, to which I eluded earlier. But the policy provides for doing these things in such a way so as to have the least permanent impact on the wilderness.

9. There will be no buffer strips around National Forest wildernesses.

10. Non-Federal lands within National Forest wildernesses will be acquired by appropriate means.

11. Reasonable measures for the protection and safety of visitors will be provided consistent with the concepts of wilderness. Such measures will not extend to the normal risks inherent in wilderness travel.

12. The native fish and wildlife in the National Forest wildernesses should exist and compete in an environment where the forces of natural selection and survival operate with optimum feasible freedom.

a. Wildlife crops will be harvested under the laws of the State Fish and Game Department concerned.

b. Vegetation may be manipulated only when the need to maintain a wilderness quality is evident.

c. Predators may be controlled where the need is well established. Control programs will be under the supervision of the Fish and Wildlife Service. Poison bait and cyanide guns cannot be used.

d. Rodents may be controlled if the need is well established.

e. Fish stocking is permitted when needed and will ordinarily be done under the supervision of the State Fish and Game Department. Native fish species will be encouraged in waters which will support them.

I believe we all recognize that there are wide differences in terrain, geographic characteristics, vegetation, climate, and animals between wildernesses. These also must be recognized in the management plans developed for each unit of wilderness.

We on the Wasatch are currently working on management plans, specifically for the High Uintas Primitive Area, which hopefully will be placed in the Wilderness System in the not too distant future. Some of the main provisos of this plan are:

1. Provides for wilderness patrolman to assist the user, distribute the use away from areas of heavy concentration, light trail maintenance, fire prevention and perhaps control, clean-up of specific areas, promote the idea, "Take it with you."

2. Provides for those improvements that are necessary for the health and safety of the user; such as, development of springs, primitive toilets, and perhaps simple tables and fire circles where their use will enhance and protect the wilderness values; i.e., reduction of fire risk.

3. Provides for the resolution of conflicts between permitted livestock and recreation stock.

4. Provides for a trail system designed to fit the wilderness; a trail system that will disperse use, point the way through the country, and provide the necessary safety over the rough spots.

5. Corrects the conditions that have grown up over the years that are incompatible with the wilderness concept.

6. Keeps the use impacts of pollution and site deterioration to a minimum and away from the streams and lakes.

We have just reviewed some of the objectives and policies pertaining to wilderness management; tools of the administrator. So, where are you involved? If you think you are not, let me dispel that complacency now. Some of you are involved now, and as time goes on and more and more people use these areas, more of you will become involved and to a much greater extent. How? Perhaps like this:

Modern man and his method of use of the wilderness is, for the most part, foreign to the ecology of the area. Early man, on the other hand, learned to live within the delicate balance of nature and was a part of it. Lightning and its fire is a natural occurrence; man caused fires are not. Insect and pathogens are an integral part of the ecological process; man's upset of the natural balance and subsequent insect epidemics are not.

We have already said that the ecological processes will be permitted to operate naturally. There may be some exceptions. We are now called upon to place a line around an area and call it wilderness. Many factors come into play in the positioning of this line. To the degree that we are successful in recognizing the ecological processes in placement of this line, we can let the processes operate naturally. For example, a patch of timber becomes infested inside the area. Do we go in and control the epidemic or not? As the administrator responsible for the decision, I've got to know some answers; pretty quick! Will epidemic cover a large area? Will it spread into the adjacent overmature timber outside the area? Will the dead snags represent an intolerable fire hazard that will threaten other parts of the area? The resources outside? Will it be a complete kill and lay the soil open for accelerated erosion? Will the reproduction be unaffected, protect the site and lead to an opportunity for scientific study? If control measures need to be taken, what are those that will have the least permanent impact on the wilderness? How are the other ecological processes affected by these control measures? What if fire occurs; man made or natural? What will the subsequent insect incidence be? Can I let the fire burn, because to control it may have a lasting impact on the wilderness? An interesting decision was made last summer, when a fire occurred in the Idaho Primitive area. It was decided to let it burn; some 5500 acres. In order to control this fire, roads and catlines would have had lasting impacts on the area. Also the total available fire suppression forces were committed to several large timber fires at the time. This became, in relation, to values--low priority. The point being, however, sometimes we don't have much time to come up with the total information on which to base the decision. Yet, gentlemen, you are involved and this involvement will increase.

In conclusion, I would make one other point. Royce eluded to this during the morning session. You are the experts and I, as an administrator, need your expertise and counsel. At times you may be part of the team furnishing the facts on which any given decision is made. To make a wise decision, I need to know the facts, the cause and effect, and most importantly - the alternatives. On occasion, when everything is said and done, a decision is made that appears to be contrary to scientific insect control procedures. Recognize that there are many factors and interests involved in Wilderness management. None of them operate in a vacuum. You have done your job and fulfilled your role on the team by supplying the facts, providing the alternatives--the decision in my present job is mine. Who knows, I may even have to live with a wrong one, but sooner or later someone is going to "punch the button and go!"

I appreciate the opportunity to share with you some of my views and problems and wish you success in this important work conference. Together, whether within the Forest Service family or through the interplay of private and government programs, we can realize our goals and meet the demands of this and future generations.

Thank you.

Gearing Entomology to Forest Management Objectives

HIGH USE RECREATION

By

Fred F. Dickison

High Use Recreation--a somewhat indefinite term--can best be illustrated by resorting to published travel forecasts for 1967 of visitors to the areas comprising the National Park System--estimated to exceed 140,000,000. How many of these visitors will see the ravages or notice the damage of insects to vegetation or forests during their visits is not calculable--but notice, they will form opinions accordingly as to our forest resource management efficiency. Unfortunately, we'll have little or no chance to explain the role insects play in the ecosystems. Were we to do so to the average visitor, undoubtedly we would be reminded in some manner or other than in essence "parks are for people, not bugs." Fortunately, approximately 95% of the visitors are largely contained in about 5% of the total forested area--depending on where they are at any one time--so what may have been noticed and is being complained about could only be a small segment of the whole problem, or perhaps not even related to the serious problem; example, "tent caterpillars keep falling on our bedrolls--somebody ought to do something about it," while Dutch elm disease could be taking the principal species. Most of the complaints of this nature are satisfactorily explained away, with the real damage to public interest and the resource itself sometimes being made by well-intended scientists in fields of one sort or another, overemphasizing incidental and side effects of control, which result from controlling the target insect that has been "out-of-balance" so to speak with the environment.

The "old saw" "an ounce of prevention is worth a pound of cure" was never more true than in the case of insect infestations in developed areas where public use is high and intangible recreational values of the forest far outweigh any conceivable commercial value of the forest stand or canopy. A "so-called" secondary insect inflicting minor damage--and considered tolerable for commercial forests--could not be tolerated in a highly used recreational forest. While we appreciate, as forest managers, the complexities of accurate biological evaluations of any given insect infestation at any one time, perhaps if the forest entomologist would indicate an imbalance of insect populations is possible or probable in certain localities considering site, tree species, etc., we could initiate damage prevention programs of a type that would not ordinarily be considered from a timber management standpoint alone. What are the prospects for this? Is there enough research being done specifically along this line? In addition to aesthetic considerations there is also the visitor protection and safety feature to be considered here. A number of accidents to visitors occur annually from trees falling for one reason or another, including insect depredations, and tort claims can result despite the conduct of hazardous tree inspections and other management functions being regularly carried out. What are the prospects of research developing natural predators fast enough for practical use in developed areas? What management techniques can an entomologist recommend for developed areas, such as use of insect repellents, to perpetuate existing stands of "so-called" sub-climax species as lodgepole pine where considerable monetary investments have been made in public use facilities, dependent for the most part on a forest canopy being present. How can entomologists educate the general public as to the need and necessity of carrying out direct control programs when imbalance of insect populations exist to the extent that forests of certain species can be destroyed? We hear a lot about ecology today--it's a very popular "band wagon" to be on if you are a resource manager. How can entomologists help the resource manager to place insects in their proper "niche" of the total resources to prevent any imbalance from occurring?

Well, gentlemen, these questions may appear as if we don't know what we are doing with insect imbalances in the forest, which is far from the truth. From a personal standpoint I've seen very successful control or suppression projects carried out, using the best methods and latest research forest entomologists could obtain. Perhaps the criticisms of control programs and their degree of success are traceable to our own "front door" when we fail to explain or publicize our results or objectives. We should remember criticisms come in many forms. Constructive criticism is always beneficial and destructive criticism can be harmful only when not preceded by constructive criticism--in short, don't get so involved in doing the job that you fail to adequately inform everyone what your accomplishments are. In summary, gentlemen, what can you do to "glamorize" your business and better serve the forest resources as well as the public good?

Referring again to the mountain pine beetle as an example of an emergency problem, this insect is currently killing at least $2,500,000 of white pine annually, most of which is in federal and state ownerships in northern Idaho and western Montana. In addition, this beetle is causing serious problems in ponderosa and lodgepole pines in other parts of the Western Pine Region. All forest managers I've contacted feel we need a more aggressive research program. I cannot agree with the reasons given for deferring a greatly expanded effort to at least try to cope with such an extreme emergency. Neither can I accept the argument that an expanded research program must wait until a new laboratory is constructed, equipped and staffed.

I want to stress that forest managers, both private and public, recognize the need for and have aggressively supported expanded laboratory facilities when justified. But this doesn't answer emergency situations because years are always required to accomplish the political action necessary to obtain the appropriated funds and to construct the facilities.

We know from hard experience that emergencies are bound to arise. Administrative branches have recognized this by developing organizations and procedures for control operations, yet they are frequently handicapped by lack of knowledge because research agencies have failed to provide adequately for emergency studies.

At this point I have another question--a sub-question of my basic one about more flexible research programs. Why can't research emphasis be shifted temporarily to meet an emergency, utilizing existing facilities and personnel? Part of the reason for not shifting lies, I know, in the practical consideration of the effect of disrupting existing programs. However, another reason is the resistance of individual entomologists to be even temporarily diverted from their particular field of interest. Frankly, in my opinion, neither one of these reasons is completely valid in the face of a serious emergency. As a forest manager I confess I am naturally impatient and perhaps too unsympathetic toward research which does not build a foundation for solution of our highest priority problems. To me it seems inefficient, if not uncomprehensible, that some good, capable entomologists are actually following such obscure research as the wing venation ontology of minor insects and yet they are apparently oblivious to, or at least unconcerned about the millions of board feet of timber killed annually by insects.

And, not being a taxonomist, I often feel that much of the time and effort spent in fretting about fine points of classifying and naming insects could be better spent on research into more practical problems such as improved control methods. This is not to say we should be oblivious to glaring errors in taxonomy. (Incidentally, if there are any taxonomists present who are still concerned about what to call the mountain pine beetle, I will be heppy to furnish you with plenty of names--although none of them would be printable.)

The point I'm trying to make is that time, talent and money for forest research will always be limited--especially in face of the competition from more glamorous and politically rewarding programs of the Great Society--so we must set priorities and give specific direction to research programs if practical results are to be achieved in the shortest possible time.

This leads to my second sub-question: Is adequate direction being given to forest insect research? In partially answering my own question, I think there is room for improvement. Directed research has worked well in many problems of industry and is the only way to obtain quick results. Even though the results may not always provide positive answers to a given problem, they at least contribute to the fund of knowledge necessary to point the direction for further research. There are, of course, many arguments against too strictly-regimented research, not the least of which is the danger of stifling individual interest and incentive. But in view of the tight money situation, I wonder if we can afford the luxury of letting individuals pursue their private hobbies or interests at public expense. Surely there are ample practical and important problems to absorb the talents of all existing entomologists if their interest could be directed toward these problems. Perhaps this is not a major concern in forest entomology, but I assume it may be. I've been told there is a shortage of forest entomologists, although I'm inclined to wonder about this after observing the large attendance at this conference. Perhaps an inventory and evaluation of forest insect problems, existing projects and available entomologists should be made to re-establish priorities and to coordinate a more intensive direction of research. If there is truly a shortage of forest entomologists, perhaps there are qualified people working on relatively unimportant projects in other fields who could be attracted to forestry problems. Certainly there is a tremendous challenge!

My third and final sub-question is: Are governmental forest research agencies making adequate use of outside contract research? The tendency of forest research agencies is to continually strive to build up their own staffs and facilities on a permanent basis. However, from a practical standpoint, the rate and extent of expansion is now rather severely limited by federal budget policy. Yet there are excellent private and endowed research groups capable of handling many of the problems the federal agencies say they can't handle because of lack of men, money and facilities. I feel the quickest most efficient and most economical way to fill this serious gap is through more contract research.

Encouragingly, the trend has been at least started by the U. S. Forest Service through their contracts on bark beetle pheromone research with the University of California at Berkeley and the Stanford Research Institute. But this is only a start. Perhaps there are other governmental contracts I don't know about. In any event, I feel the procedure should be greatly expanded. If existing non-governmental research agencies are effectively utilized, some of the planned federal facilities might not be necessary. I realize this may ring as a sour note in the ears of some, but the proposal is at least deserving of much more serious study by research planners.

Before concluding, I feel I must set the record straight by announcing that my employer, Potlatch Forests, Inc., has agreed to continue for a second year a study of the mountain pine beetle problem, with the aid and cooperation of the Boyce Thompson Institute for Plant Research.

This field project will expand studies of beetle behavior and will strive to develop methods to utilize the natural attractants produced by the insect and its hosts as a device for manipulation of forest populations of the beetle.

In addition, the private forest landowners in Idaho and the State Cooperative Board of Forestry are finalizing an agreement with Boyce Thompson for a project to collect, analyze and (hopefully) synthesize the various volatile compounds produced by D.p. and its hosts which are involved in flight orientation, host finding, and mass attack. Included will be further studies of laboratory and field bioassay methods essential to verifying the attractiveness of compounds isolated and synthesized.

I want to make it clear that in striving to develop a method for controlling the mountain pine beetle, we are making no advance claims of success. But, in the opinion of the forest land owners I have contacted, the timber values at stake fully warrant an aggressive effort.

Those of us who must live, day-to-day, with the problem of such excessive timber losses feel we simply can't sit on our hands, waiting for appropriations from Washington--which may not come.

For the last fifteen years we have been chasing the mountain pine beetle through selective salvage operations. We have also conducted some direct control by treating infested trees. While these efforts have helped control the insect in certain areas, they are expensive and difficult to maintain over such a large infested acreage. In addition, the increased proportion of white pine harvested creates marketing problems, as I pointed out earlier. We desperately need a method of attracting at least part of the beetle population to more accessible locations where they can be more easily exterminated and where infested trees can be more readily salvaged. We will be happy if we can reduce pine mortality by even one-half or one-quarter in moderately infested stands because this would enable us to do a better job of concentrating salvage operations in the more heavily infested stands.

There is, of course, no guarantee that this expanded research effort will develop an effective method of control, but we feel it is the best hope currently in sight. In any event, we are confident we will at least have contributed significantly to the fund of scientific knowledge about *Dendroctonus ponderosae*.

In summary, gentlemen, I simply repeat my questions for the consideration of this Conference:

My basic question is: Why can't forest entomological research be made more flexible to meet emergencies as they arise?

My secondary questions with respect to hopefully achieving this flexibility are:

Why can't research emphasis be shifted temporarily to meet emergencies, utilizing existing facilities and personnel?

Is adequate direction being given to forest insect research?

Are governmental research agencies making adequate use of outside contract research?

In conclusion, I hope my remarks have not seemed hypercritical, because I've intended them to be constructive, yet sufficiently provocative to stimulate discussion. I recognize there will always be honest differences of opinion, for which I am thankful because this is conducive to advancement of knowledge and accomplishment in any field of science.

Thank you, gentlemen, for your kind attention, and best wishes for a successful Conference and for finding better solutions to our many serious forest insect problems.

ENTOMOLOGISTS' DILEMMA

By

Don Lucht

When I was first asked to present a paper on "The Entomologist's Dilemma," the first thing I did was go and look up exactly what the word "dilemma" means. I came up with two definitions. The first one I saw was: "A dilemma is the necessary choice between equally undesirable alternatives." The other one given, and which I prefer was: "The horns of a dilemma: The equally undesirable alternatives between which a choice must be made."

Well--after I thought about it a moment--it was apparent that I am in a dilemma about 93% of the time, and the other 7% of the time, I am on annual leave and thinking of something else. By definition, and probably by actual fact, then, we, as forest entomologists, are in a dilemma over 90% of the time. In most cases where we are asked by a land manager to provide him with a solution to an entomological problem, we have, usually, more than two alternatives, but all of them generally are equally undesirable. Why is this so? I think one reason is that there has been a rather rapid and drastic change in the use of our public lands, and therefore, in the technique of land management. We on the other hand have not changed rapidly or drastically enough in our coping with the problems that the land manager has presented to us. For example, in the 1900's, if an insect infestation--either bark beetles or defoliators--was found infesting or destroying, say, five hundred thousand acres of timber, no one got too excited about it. But, as the public became more aware of conservation needs and we began paying more attention to our renewable natural resources, we became more aware of the need to preserve these resources and to manage them on a sustained basis. The time finally came that people charged with this responsibility of land management became interested in infestations on fifty thousand acres, then on five thousand acres, then on five hundred acres, on fifty acres, and finally on five acres, and now today, especially in the southwest, we are concerned not only with five individual trees, but in some cases, with one tree.

One other thing that makes this a difficult situation is that we provide technical and professional assistance to many different agencies who have totally different objectives in managing forested lands. For example, the Forest Service is concerned primarily with the multiple use concept, whereas the Bureau of Indian Affairs is concerned with the greatest return to the indian, and the Park Service of course, is dedicated to preserving the aesthetic values of the forested lands for the enjoyment of the visiting public and future generations.

Depending on which agency forester you are talking to, or which one has requested assistance on a technical matter dealing with the field of forest entomology, the acreage values are greatly different. Even within our own agency, the recreationist looks upon an area of sixty acres, in the light of people use, as just as important as six thousand acres of timberland is to the timberman. We must, therefore, answer the recreationist in the Forest Service, the forester within the Forest Service, the forester within the Bureau of Indian Affairs, and the forester within the Park Service, differently. Therefore, we must remember who we are talking to, what the problem is, what his objective is, and what we are going to tell him. I think you can readily see that this can and has very rapidly become a very complex situation, and we must come up with some answers. What are these answers going to be?

Can we tell the recreation staff officer within the Forest Service that "This is a recreation problem," that "We know little of this insect," that "We are going to have to ask research to apply a basic research technique to find out about it--and it will probably be five or six years before we have anything to tell you definitely?" Or are we going to have to go another way and say, "Well, it's up to you; it's in a small recreation area and we are not interested in this type of an entomological problem?"

Are we going to tell the indian forester that, "Well, we have nothing to tell you, that more research is needed?" Or as far as the Park Service goes, "Well, this is a tree; you have no logging procedures; you don't log on National Park land; you are just going to have to let them die; you want the area in the natural state anyway." Well, I don't think these answers are very good, but are ones that we must often give. What do we do? We are in a dilemma again. In fact, we have never been out of it.

Going back a moment to my five hundred thousand, fifty thousand, etc., acres example, I think it is quite apparent that somewhere along the line, probably between five hundred acres and fifty acres, that we must change concepts from the forest entomological concept to what you might call "The shade tree" concept. That is, where individual trees are of high value and that we treat them as individual trees rather than on the overall basis of acreage and timber yield.

In other words, we are going to the ornamental type of approach and I think it is quite obvious that we are going to have to give answers to these problems on this type of a situation whether we like it or not.

As recreation becomes more intense, more people want to get out in the wilds and enjoy this type of recreation, we are going to have to become more interested in this type of a situation, and come up with answers on a much faster basis than we have in the past. But where are we going to get these answers?

I think that we are going to have to come up with an approach between pest control and research--to answer these questions either individually or in unison with each other. Whoever does this work, whether it is by each other or together, we are going to have to come up with the answer a lot quicker. But this is going to take, I think, a few years before we can apply this approach, and in the meantime, we are going to have to say to the land manager, "Well, we don't know."

Say, though, for example, that we do approach this in a new and different way, are we going to continue to use the basic technique, rather than the applied technique?

Do we need to know each little detail of each insect's activities, whether he has so many setae on the abdomen, so many on the thorax, that he has a certain type of eye, and that he has a certain peculiar morphological characteristic? If this is necessary to immediately alleviate the problem, fine, but do we have to go at it and keep at it for a number of years and report in each detail, the minute facets of this insect's activity, or can we go and get enough information to try to control this thing immediately and then maybe proceed on the basic technique at a later date? In other words, can we, for example send some eggs or larvae to the insect screening lab and have them screen materials for us, if the problem is pressing, and ask them to give us a good idea of what materials will work and go out and try a suppression project?

Again, must we know every detail of the insect that we are dealing with? Do we have to stay within our tent and not take chances or try something new, in an effort to answer these people? If we leave should we be treated harshly by our peers for venturing forth from the tent of tranquility on something less than an absolutely indestructible web? I think, then, as far as the land manager is concerned, it is quite apparent that we do not have all the answers that they would like to have answered, or that we do not and will not ever have all the answers to the questions that they may ask us. Again, why is this so?

Well, it is so because of the changing techniques used by the land manager, and the rapid pace in which certain areas of land under management is being put to, for example, recreation. Recreation use pressures are increasing tremendously on all lands, and as these become greater, more effort is being made to try to protect the resources on these lands, and until we can come up with some different answers, we are going to have to say, "We don't know." Then we may ask the researchers and ourselves, "What are we doing to change this concept or change this idea that 'We don't know'?" How are we going to go from something we don't know to something we do know? Are we going to change our techniques? Are we going to work in greater unison? Are we going to do it on our own? Or are we going to do nothing? I think we all agree that doing nothing solves nothing. I think we all agree that working in unison is the best approach to a progressive solution. I think we can see a change for greater unison already. Now should we not try to speed up the process? Still, some skeptics may ask, why change, we are getting by.

A now ancient roman emperor once said, "Observe constantly that all things take place by change." Thus, we must change. An infant must be changed, but as professional men, we can change ourselves. Let's throw away the safety pins and the medicated talcum powder, and leave the frass to Jack. Let's be in a dilemma only 7% of the time and on annual leave the other 93% of the time.

WHERE'S THE PIPELINE?

By

John R. George

It is indeed a pleasure to be here today. This is my first opportunity to attend one of your meetings. I have never met many of you, but I have seen a lot of the names that appear on your program on the entomological pipelines through the years. I look forward to the opportunity to become acquainted with you this week.

"Where's the Pipeline" as a topic made me start a hunt for a definition of pipeline before I could use the pick and shovel to find it. For the purposes of this discussion, I have defined pipeline as "keeping the family informed."

As is usually the case, one situation brings on another, so now you ask, what family or whose family? Here, I am considering everyone a member of the family who has an interest in forest entomology. With that premise, the base quickly broadens so one doesn't begin to know where to dig for the pipeline. Basically, the family, so far as participation in your conference is concerned, includes representatives of the following groups:

1. Industry
2. Government
3. Universities and Foundations
4. Professional societies and associations
5. Mr. and Mrs. John Q. Public

So, with individuals from these groups connected to the pipeline, what lines do they use to keep one another informed? We can carry most informational interchange on these four trunk lines:

1. Publications
2. Personal contacts
3. Television and radio
4. Meetings

As you can readily see, each of these trunk lines has many feeder lines of various types and capacities.

Since we are attending a meeting here this week and devoting much time and considerable money to it, appparently the conference group considers meetings a key pipeline. Many others must agree about the key role of meetings as more and more of us spend more and more time in them. I cannot help but wonder, after attending some meetings, if we could not be buying much more from them if they were planned with definite outputs in mind.

Primarily, meetings give us a good atmosphere for the exchange of ideas. They also offer us an excellent opportunity to solve problems by team dynamics, but I wonder whether we use this tool of pooling knowledge, interchanging ideas, developing alternatives, and analyzing them as often as we could in developing recommendations and programs.

This approach to increasing meeting output and effectiveness could include the following steps:

1. Exchange ideas on the problems to be solved.
2. Develop accurate descriptions of the most important problems to be considered.
3. Describe how the problems are to be resolved.

    a. When
    b. Where
    c. By whom

4. Arrange for early distribution of information covering decisions made in the meeting to:

    a. Participants
    b. Others involved in the recommended actions.

5. Provide for followup to assure completion of the work started at the meeting.

COMMUNICATION IS A TWO-WAY STREET

By

Ron Stark

Recently, Alan Berryman of Washington State University sent me a mimeographed copy of a lecture given by a Dr. Ralph G. Nichols of the University of Minnesota. The title of this talk was "Listening is Good Business." I read it with a great deal of interest, circulated it to all my graduate students, and forgot about it until I received the program announcement of the current Western Forest Insect Work Conference. Shortly before receiving the program announcement, I leafed through a copy of Nation's Business magazine (this is not my normal reading material. I believe I was waiting for a doctor's appointment and it was the only magazine he had), and ran across an article "Now Hear This" which paraphrased almost everything that Dr. Nichols had said.

Dr. Nichols had emphasized the importance of good listening habits to a college professor, to students of all ages and scientists. The article in Nation's Business was written from the point of view of a businessman. Business firms have become so convinced of the importance of listening that many large corporations are now requiring their administrative employees to take special courses in listening. In the past year or two over 100,000 such businessmen have taken a "listening" course and it is acceded by all that it has been profitable.

I feel the principles put forward by Dr. Nichols are so important that they deserve a place in this symposium. I have the impression from the titles of the four talks to be given that the emphasis is upon the delivery of information to the user. As I will attempt to show, based on the studies of Nichols and others, the onus of utilizing that information is on the hearer as well as the deliverer.

First a few statistics based on various researches.

1. 98% of all that a man learns in his lifetime he learns through his eyes or through his ears.

2. 70% of our conscious waking day is spent in communication. Seven out of every ten minutes that you and I are conscious, alive and awake we are communicating.

3. Of this 70%, 9% is spent in writing, 16% in reading, 30% in talking, and 45% in listening.

Now these statistics created quite a commotion among educational circles, for the American school system is built upside down. From the beginning of elementary school right through the highest degree a university can offer, our greatest emphasis is on reading. Much less time is devoted to talking and prior to less than a decade ago practically no time at all to the fundamentals of good listening. Nichols found in one year's period some 3,000 scientific and experimental researches completed and published in the medium of reading. Only one had been completed in the field of listening comprehension.

Within the past decade, however, there has been some change. About 125 Ph.D's have been granted in the field of listening comprehension, scores of industries have instituted their own listening training programs, and three departments of the Federal government have followed suit.

Nichols presents amusing, but at the same time frightening, examples of the problem of listening in school, in business, in church, indeed in all areas of our life. He regards the matter of listening as a human personal responsibility in effect every hour of every day and which requires, if not formal training, rigid self-training and discipline. After much thought and reserach Nichols has come up with what he calls the ten worst listening habits of the American people. I believe these deserve a place in this program and they are so important that I have had them mimeographed so that all of you will have a copy to read if you do not listen. I have paraphrased some of these slightly to make them more topical for this particular group.

Bad Listening Habit No. 1 is calling the subject uninteresting. Many times the listener will do this as soon as the chairman announces the topic. He says: "Oh, communication and listening, I write articles and I can hear just as well as the next fellow. Everybody is worried about communication. If they had something interesting to say, then I would listen." Having judged the speaker and the topic before hearing anything other than the title of the article, he then drifts off on some other mental tangent of concern to himself, such as how to beat the crap tables in the lounge.

The good listener starts at the same point, perhaps with the same reaction, but comes to a different conclusion. After having inwardly voiced his complaint he says to himself, "Just a minute, I'm trapped in here, it might be a little embarrasing for me to walk right out so I'll see if there's anything this guy says that I can use."

The key to good listening is that little three letter word use. The good listener is a sifter, a screener, a winnower of the wheat from the chaff. He is always trying to find something practical or worthwhile to store away in the back of his head to put to work for his own selfish benefit in the months to come.

G. K. Chesterton summed it up in these words: "In all this world there is no such thing as an uninteresting subject. There are only uninterested people."

Bad Listening Habit No. 2 is criticizing the speaker's delivery, thus blocking out any possibility of his words getting through to you and, if you are a vocal critic, those around you as well. With some, this gets to be an indoor pastime, the extrovert seeing how many laughs he can get from the acquiescent listeners around him. Again, the good listener may also have a poor reaction to a man's delivery but, again, he comes to a different conclusion. He may decide that he is the worst possible speaker he has ever heard and wonder why they did not ask ten other people but then he reflects that perhaps there was a reason for choosing this man. Depending upon his personal relationship to the speaker, his assessment of his importance might vary but he decides that the choice of this person must have been based on some sensible conclusion and determines to get whatever good there is out of that man. Usually, an amazing thing happens. Not many moments go by before the faults of the speaker become oblivious to the listener and the message starts coming through (if there is a message).

An appropriate illustration might be that if one of the muscular attendants one sees hanging around the local nightclubs came in and in profane, broken English announced that there was free booze in the Stardust Lounge, I do not think we would criticize his delivery or ask him to repeat it in better English, I think the line would start forming immediately. The point is that the message is always four times or more as important as the clothing in which it comes dressed. As soon as we recognize this simple truth we are on our way to becoming better listeners, because we begin to assume half the obligations for completing each communication.

Bad Listening Habit No. 3 is getting overstimulated. The degree to which any one of us gets overstimulated at meetings such as this varies. I am not talking about the kind of stimulation we will have Thursday night nor which many of us have every night this week. I am talking about the reaction to the speaker. This will depend on whether the speaker is dwelling on some topic with which we are either conversant or interested. I am sure at one time or another all of us have become overly stimulated and have spent the whole period of the man's talk thinking up terrible questions which we may ask the speaker to embarrass or contradict him, or mentally composing a great rebuttal speech to give as soon as he sits down. I personally have seen cases where an individual has leaped to his feel and delivered an impassioned oration on some point made early in the speaker's talk only to have the ground cut under him by either the speaker or others saying (in a rather disgusted tone of voice) that the speaker himself had either corrected or presented the same contradiction. Usually, when one is overstimulated listening efficiency drops to zero percent.

The corrective measures for this bad habit are "Withhold evaluation until comprehension is complete" and if you are passing this on and you are afraid your audience might not understand those words you might say "Hear the man out before you judge him." Most of us are snap-judgment makers and we just cannot wait to fully understand the proposition before we decide to accept or reject it. (This may be good advice here in Las Vegas, i.e., hear the proposition out before you decide.)

Bad Listening Habit No. 4 is listening only for facts. In carefully conducted tests Nichols found that the hundred worse listeners listened for facts and of the hundred best listeners 97% listened for the main ideas, the main generalizations, principles or concepts. Nichols came to the conclusion that the good listener is always the idea listener. He does pretty well understand the central idea and uses this to give sense and system to the whole discourse. Even if it is facts that are desired, the best way to get them is to get first the principles that limit or control them. Then we have a chance to retain and make use of those facts in the years ahead.

Bad Listening Habit No. 5 is trying to make an outline out of everying we hear. Such a habit is not too prevalent at meetings such as this for very few people bother to take notes, relying primarily on the proceedings. However, because of our training, we probably think in forms of an outline. There is nothing wrong with outlining a speech if the speaker is following an outline pattern himself and perhaps he even should be, but a conservative estimate has been made that no more than half the talks we hear are going to be given by speakers skillfully following an outline pattern of organization. Only frustration occurs if we try to outline the unoutlinable. Listening stops while the listener spends his time developing a beautiful organizational chart for what he cannot hear.

The cure for this bad habit refers back to Bad Listening Habit No. 4, i.e., listening for facts rather than principles. Nichols found from his test students that one of the best ways of getting the maximum out of a talk was to have a dual note-taking system where on one side of a page one lists the principles or concepts, on the other side the facts. The beauty of this system is that it does not make any difference whether the speaker is well organized or confused. If he has any facts or principles in his discourse you can screen them out. What all this really means is very important. It should be emphasized that the good listener is a flexible, adaptable kind of note taker who adjusts his systems to the organizational plan the speaker is following, or the complete absence of any such plan at all.

Bad Listening Habit No. 6 is faking attention to the speaker. I am sure all of us in our own way have developed methods in our college years, for church use, or committee use where we can give the appearance of listening and enjoy the privacy of our own mind without any disturbing elements intruded by the speaker. These nonlisteners are very hard to ferret out; the speaker really has no way at all of knowing how many of the group are listening to him unless he has had considerable experience with the group such as a teacher has with his students.

Good listening is not relaxed or passive at all. It is characterized by a quicker beating of the heart, faster circulation of the blood, and a small rise in body temperature. It is energy burning and energy consuming. In plain words, it is hard work. The best meaning of the word attention is a collection of tensions inside the listener that can be resolved only by getting some facts or ideas the speaker is trying to convey.

Bad Listening Habit No. 7 is tolerating or creating distractions out in the audience. The good listener is one who lets the speaker know that he is inaudible and goes out of his way to quiet down those people making disturbances which inhibit listening.

Bad Listening Habit No. 8 is evading difficult material. Again, good and bad listening habits were found to be related to the personal habits outside of educational habits of the people involved. That is, bad listeners were those who did not even tune in educational television or discussion or thought-provoking radio programs. Instead, they were the ones that make up the television ratings responsible for our current level of programming. Those of you with children take heed.

Bad Listening Habit No. 9 is letting emotion laden words get between us and the speaker. This is a curious business but it has been amply demonstrated that a single word may cause some listeners to tune a speaker out. Some emotion words listed by Nichols are "evolution", "clerk" for retail sales personnel, "automation", "pink","fellow traveler", "communist", "big business", "Ronald Reagan", and "tuition", are two that I have added.

Now it is all very well for you to laugh and say "This is silly", but it has been demonstrated again and again that this actually happens. I do not envy the speakers on Friday morning if they happen to use any words connoting mammary in any of their talks of use bimodal graphs, for I am sure that this will be an emotion-laden word. Hopefully, this little paper might help to prevent inattention.

We all know that the word is not the thing; it is merely a symbol for it. Yet, it is also well known, though not admitted, that we go through this life of ours letting such symbols stand between us and selfgrowth.

Bad Listening Habit No. 10 is the most important of all. It has been established that on the average we talk 125 words a minute in conversation; on a podium or in a lecture hall speakers slow down to 100 words a minute. It is equally well established, however, that the easy cruising speed of thought is always at least 400 words a minute. Now before you jump to any conclusions, this differential between 100 and 400 is a pitfall, a breeder of false security and mental tangents. What actually happens is what has been happening in this hall all morning. You have been tuning speakers in, and in ten seconds have been able to identify what any particular speaker was up to and have felt free to rip off on a 50-second mental holiday (which most of you probably did). Then, because all of you feel an obligation to the Western Forest Insect Work Conference, you cagily checked the speaker in again, and in another ten seconds found out what he was up to at that point and ripped off for another 50-second holiday. You were in for ten, out for fifty, in for ten, out for fifty, for several minutes. However, sooner or later, on one of these mental excursions you probably hit on a topic so interesting that you could not hope to leave it. Now these excursions can have infinite variations and most of them, hopefully, can be enjoyable. However, you have not gained what presumably you are here to gain. Mental island hopping is the reason why we listen with some 25% efficiency.

Thinking faster than a person talks (it has been estimated that in a scientific audience the average thought speed should be something like 800 words a minute rather than 400) need not be a handicap. It ought to be one of your proudest assets. To convert what appears to be a liability into an asset requires only the continual practice of three mental activities every time we hear a sustained discourse. Nichols calls these three things the ingredients of concentration.

Ingredient No. 1 is to anticipate the next man's point. Run ahead of him mentally. Try to guess what point he is going to make and think of it with a capital letter attached. Then check up to see whether you guess right or wrong. If you guessed right the point gets to your cortex twice instead of once (and you have verified your opinion of the speaker). Learning is reinforced. If you guessed wrong you are still a winner.

Out of curiosity, most of us begin to compare Z with A, the point we guess and the one he made, and we are then applying one of the three oldest laws of learning in the textbook, which is, that we learn best by contrast or comparison with something else.

Ingredient No. 2 is to identify what he has for evidence. No longer can a man go through life just asserting points. He has to build them, to be able to identify the materials he used.

The third ingredient of concentration is the most important. It is to recapitulate periodically as we listen. The good listener will tune the speaker in, listen hard for four or five minutes, and then take a quick mental time out. In that time he will hastily summarize in his mind the best points made in the preceding segment of discourse. In ten seconds' time with that enormous thought speed of ours we can rephrase in our minds the best points made in five minutes of talk. Half a dozen of these mental summaries interspersed through a 45- or 50-minute lecture just doubles our ability to understand and recall its contents. These three ingredients, anticipation, identification, and recapitulation should use up this differential of thought over speech to great advantage to ourselves. This little bulk should not take more than two such mental excursions.

Nichols closed his lecture with a quotation from the Bible and I do not think it out of place even here in what has been called a 20th century Sodom and Gomorrah. From the fourth chapter of Mark, 23rd and 24th verses: "If any man have ears to hear let him hear. With what measure you mete, it shall be measured to you. . . and unto you who hear, shall more be given."

INFORMING THE PUBLIC

By

Clyde M. Walker

If you are looking for signs that forestry has problems in informing the public these days, you need not look far. I had planned to beat you over the head with examples of demands for special dedications of forest land and of excerpts from criticism of resource management. But the keynote speech and the obvious concern for communication problems at this meeting show that motivation is the least of your needs.

I don't mean to suggest that our problems will go away because our hearts are pure. If anything, criticism is likely to increase. Our work will be increasingly exposed to public view by generations of young men and women who schooling includes conservation education and who have time and money for travel and outdoor recreation. But the chief difficulty--as Ed Capps, a California outdoor writer, told the California Nevada Section of the Wildlife Society in January 1967--is that "people are against you because they don't understand you." An increasingly urban population has a hard time connecting the management of forest resources with its daily needs for forest products and services.

What can we do to promote understanding? Three things: (a) Strengthen internal information programs, (b) Meet and talk to the public (more accurately, our many publics, which include professions, hunters, campers, etc.), (c) Learn to work with and assist the mass media.

Good internal information has to come first in a field increasingly dependent on science and technology. It is axiomatic that public information starts with internal information designed to assure effective management. New information promptly and effectively applied makes good sense economically, and it sure helps public relations to have our best foot forward. The man in the field is the retailer of new information, and often the only direct contact with our publics. But if he is to put his best foot forward, we may have to do something about bridging the gap between research and management--a gap pointed out recently by J. W. Macon, research forester of Consolidated Papers, Inc. (J. Forestry 65(1):24-28, 1967). Although I sense excessive longing for the "good old days" of forestry in Macon's article, I think he has some ideas for closing the gap that deserve serious study.

But we can't stop with internal information. Somehow we must shake the habit of talking chiefly to ourselves. Through taxes and purchases, the public supports both resource management and research.

The public certainly deserves to know what's happening. We should look for and encourage "spokesmen" with a knack for communicating with service clubs, youth groups, and by all means, with our own practitioners and other professional groups. We can't leave the job solely to "in-house" programs. What can the professional society--both the organization itself and the individual members--do to pass the word along?

Whatever you do, though, knock off the "let Goerge do it" attitude that leads to over-dependence on the public relations department. Remember what happened to Miles Standish when he relied on John Alden.

Don't expect public relations specialists to save a lost cause. If you are scheduling an action program, anticipate problems and make a plan to deal with them. A good example of this approach is the U.S. Forest Service's I&E plan for budworm spraying in the Sawtooth National Forest in Idaho this summer. It covers all the bases, including forest staff, community leaders, and the mass media. And remember that dealing with problems doesn't always mean putting the other guy down. If there is conflict, question your actions and motives as well as the other guy's. You may find taking a second look more profitable in the long run than defending the status quo. The best procedure is to work together. Above all, the public relations specialist should be called in to plan fire prevention, not to put out a running fire.

In the long run, though, to spread understanding as widely as possible, we'll have to turn to mass media--newspapers, magazines, radio, TV, and other audio-visual activities. Here again, the temptation is to "let George do it." Public relations departments can help you with news releases and with advise on timing, presentation, special requirements of the mass media, and contact with media pro's. But all of us need to get acquainted with, and appreciate the problems of those who work in the mass media. I have a hunch that failure to understand their problems is one of the main reasons for complaints about inaccuracy and inadequacy of coverage of natural resource news.

Remember reporters and writers work against a cruel deadline. Pressure of the deadline cuts down the chance to check every detail. And they can't exploit every lead. If they are interested, they'll seek you out for an interview. If they're not interested, wild horses couldn't drag them. Remember, too, that specialists in your subject are few. The general assignment reporter is not able to keep up with the jargon, significance, and background of all science and technology. Furthermore, the space and time in mass media are limited. Conservation can't expect to displace war, disease, and pestilence on the front page, unless the subject is controversial or timely. Above all, writers and editors in these media have no captive audiences. They must interest and entertain the public as well as inform.

Having worked both sides of the fence, I'd like to close with some suggestions for working with mass media--some "do's and don'ts" based on suggestions from professionals in that field.

1. Realize "people don't understand you" and be patient with questions. Be prepared to explain <u>why</u> you are studying something, your purpose, what it means <u>to</u> the average person, what the practical implications are. But don't "talk down." Use your own language, but talk plainly. And let the reporter ask questions to get the feel of your subject.

2. Avoid the temptation to support a position. Play it straight and honest. Don't try to be a censor or to cover up. If you try to mislead a good reporter, you're playing with dynamite. He is like a trial lawyer on attack. He can start digging and come up with a story from someone else. Chances are, what he comes up with will be less favorable than you'd get by levelling with him.

3. If the overall impression left by a story is okay, forget the little things. Nine times out of ten, the things that bug you aren't worth the worry. We tend to worry about what our colleagues will think, instead of what the public thinks. The mass media are for the general reader, not the specialist. If you disagree strongly with a story, go see the reporter or editor if you possibly can. Sit down and talk. But never argue with an editor in his own paper. He holds all the aces.

4. Provide a chance for in-depth reporting when pressures permit. Open the way for newsmen to talk to top people; hold press conferences on timely events; take journalists on field trips. But don't bother a reporter unless you have a good story--and can convince him it's good. Bring him a few good items occasionally, and one of these days he'll be calling you.

5. Don't demand review of reporter's copy. You may offer, or he may ask, but don't expect it. He has to satisfy his editor and meet a tough deadline.

6. Finally, remember that radio and TV are different. You won't be able to claim you were misquoted when every word is there on tape. The man is rare who looks good on the TV screen with his foot in his mouth.

It all boils down to this: Informing the public requires first, good internal information--from whistle punk to top dog; then, active dialogue with other professions and customers; and at all times, good working relations with mass media.

PROBLEMS OF COMMUNICATION IN FOREST ENTOMOLOGY

By

H. J. Heikkenen

The problem of communication in forest entomology is two-fold: involving the research scientists who produce information, and the specialists in detection and control who use the information.

Regarding the production of information by our scientists, I believe we should consider two major facets that contribute problems in communication: the selection of the research program and the quality and quantity of information produced by the selected research program.

1. Too often the selection and orientation of our research programs are based on the insect of the year, reminding me of the windmill facing the prevailing political winds concomitant with an ever-accelerated rotation of meetings.

2. The output of information is often too little and too late. At best, our average research scientist in forest entomology produces one scientific article every two years. The writing style is collegiate - cluttered with literature reviews, tabulation of field data, and often reworded and submitted periodically to various journals. Also, the continuity of research is often broken by the transfer of scientists between projects and localities.

Regarding two problems affecting communication for the specialist in forest entomological detection and survey:

1. The first problem concerns the availability of published information. Federal depository libraries (selective for forestry, entomology or forest entomological literature) are limited. There is no machine tabulation of entomological literature. If an individual has the interest and ability to search the literature, funds are usually low.

2. Secondly, the lack of continuing education programs is a serious problem. The advances in scientific technology and methods may within five years reduce to obsolensence the finest of technical educations.

But, to list problems is not enough; suggestions for improvement are also required.

The problems of research orientation is admittedly bio-political. I suggest for a goal of our work conference the revision of regional priorities of our forest pests, the revised priorities to be based on the financial losses of our commercial tree species. And that our research scientists apply themselves to studies of these pests, until their biologies are known and we have mastered the needed preventative and control techniques.

The output of scientific literature appears barely adequate. But with rising page costs, the articles must be severely edited and the selection of editors should be by vote of the subject matter divisions of our respective professional societies. The graduate schools of our universities must abandon the archaic dissertation and instead accept reprints as evidence of partial completion of the doctoral degree. Greater use must be made of the wealth of dormant information in our libraries. We should encourage the Entomological Society of America to obtain machine tabulation and recall of our literature.

The quality of our scientists lies in the hands of the university professors. Although their perogatives are jealously guarded, may I suggest the employment of research scientists in forest entomology be limited to Ph.D.'s. The university professors are also responsible for continuing education, more and better programs must be planned.

The final solution to our communication problem is a personal matter for each of us, based on our sense of professionalism.

MANAGEMENT OBJECTIVES AND INSECT CONTROL

By

John Chansler and Dwight Hestor

There were 20+ participants in this workshop with some coming and going during the session.

It was agreed that management objectives were becoming more specific as multiple-use plans were being put into effect. This is resulting in smaller areas being set aside primarily for a single use. Ski areas are an example of this type of planning.

The input-output concept in government will affect management objectives as well as pest control activities. There was a general feeling that entomologists were tiring of killing insects during epidemics with the thought that more effort should be directed toward preventive measures.

Three things came up repeatedly: communication, planning, and silviculture. We have not been getting insect control preventive measures worked into overall forest programs. The biggest weakness in communication is probably internal. Internal communication is defined as working with foresters that have a large responsibility in approving plans and establishing policies. We should also do a better job in presenting the problems as well as needed control work to the general public.

It was felt entomologists should be much more involved in setting up management objectives than has been the case in the past. More time spent in original planning could quite possibly result in less time and money spent at a later date in trying to control epidemic infestations.

Again, entomologists should spend more time influencing silvicultural and logging practices that will result in conditions less subject to insect losses. Success here could also result in less expenditures for direct control.

The pressures against the use of persistent insecticides seem to be subsiding from the peak following the publication of "Silent Spring." This doesn't mean they have a clean bill of health but some hysteria has been replaced with more facts. At least some chemical industries had increasing demands for chlorinated hydrocarbons in 1966. In some cases, at least, the cost factor is more important than residue considerations.

Management objectives and insect control are coming more and more to the foreground. Objectives of the land managers are being more clearly spelled out. Areas are being categorized into many sections such as wilderness areas, roadside zones, streamside zones, scenic vistas, recreation areas, timber production areas, water production areas, natural areas, Christmas tree areas, etc.

Each of these has a direct effect on what we do in the way of insect control. The latest amendments to the Pest Control section of our Manual point out that different reasons for control will play a major role in determining what function pays the control bill. If, for example, a recreation area needs special insect control to protect the area and value of the improvements, recreation must pick up the tab.

Management objectives could, conceivably, turn destructive forest insects into beneficial ones. For example, in a timber management area we might have a suppressed stand of spruce over topped with aspen. A tent caterpillar epidemic could kill the unwanted aspen to release the spruce. In places, such work is now being done with herbicides. To reverse this, a similar situation could occur where spruce are over topping aspen in a game management area. Here a good epidemic of the spruce budworm might favor the aspen where it is the desired flora complex. Far out? I don't think so. At an interregional spruce seminar held in Denver in January, an associate Regional Forester presented pictures of a place he felt should be maintained in aspen, at the expense of the encroaching spruce-fir type.

There are certain areas that we do not have definite management objectives established for to date. These are primarily undeveloped areas of low productive capacity. They may be too poor in fertility to produce merchantable timber or forage, to arrid to produce much water or recreational possibilities, too rough for economical development, but monotonous rather than scenic to look at. Here I doubt we should do any insect control work until the land managers come up with an objective.

Limitations on cutting practices in dedicated areas are bound to complicate entomological problems. At times we seem to be leaning more to preservation than we are toward conservation. If this is true, we will be faced with more problems and answers will be difficult to find. Public pressures may force us into large control projects in which we are only buying time, knowing full well the stand is doomed by age alone if natural factors do not hasten its end. We may find ourselves spending more time in convincing the public that control should not be done than we do in justifying proposed projects. This would be quite a change from the recent hassles with anti-spray groups.

We have recently tried to tie in Black Hills beetle control with management objectives. We have had aerial detection surveys for the past ten years. Bill Bailey analyzed some of this data. He prepared maps showing which sections of land held Black Hills beetle killed trees and the number of years killing had occurred in each section. Sections showing beetle activity five or more years out of ten were colored red. Those with killing for three and four years out of ten were colored orange. These maps made it possible to pick problem areas at a glance.

Forests are then encouraged to make sales in these areas wherever possible. Where forests do not have plans for developing the area in some manner, we are very hesitant to spend money for control. Before control we should have a reason for saving the trees otherwise why not let nature take its course.

Entomologists will need to know and understand the management objectives. They will also have to work closer with the land managers than ever before if we are to fully integrate insect control with the full field of forestry as it is developing today.

WHAT IS ADEQUATE CONTROL?

By

Rick Johnsey

Discussion was confined to control efforts involving bark beetles and defoliators. Much of the discussion involved the area of evaluation since it was felt that many of the variables encountered in biological and economical evaluations must also be considered when trying to establish an acceptable level of control.

Adequacy of control depends upon the objectives we establish, which in turn depend upon the type of outbreaks we are confronted with. The objective may be a delaying action when dealing with certain bark beetles, or it may be an attempt to minimize damage by keeping a chronic infestation (characterized by the spruce budworm) at a lower level. The level of control under these conditions would be different from the level necessary in a project designed to knock down an insect population characterized by rapid rise and decline with long intervals in between such as a hemlock looper outbreak.

Bark Beetles

Many of our bark beetle epidemics seem to be a management problem, involving silvicultural and sanitation salvage practices. Ideally, we want 100% removal of infested material when direct control is attempted. At other times we may leave slash to keep them out of standing trees while logging is going on and then destroy them. Obviously this depends on species and circumstances.

In some areas industry may not be able to move into a stand and take out infested material, yet they are dependent upon the stand to stay in business. In this case a control project may be designed to spread the loss over a number of years.

Assessment of results involving direct control of bark beetles is usually based on results in terms of tree mortality rather than population measurements. The decision to control an outbreak is also tied to tree mortality as well as population trend measurements. Participants felt that more and better sampling methods are needed for estimating absolute population numbers of bark beetles and their predators and parasites.

Defoliators

Defoliators present a different problem requiring a different approach. We usually have more sophisticated sampling techniques for estimating absolute population numbers and can delineate infestation boundaries more precisely. A decision to control may be based on population trend measurements or on estimates of absolute population numbers.

Past decision on the level of control attained have been based on percent mortality data. It was suggested that a sampling method for estimating population numbers remaining after control would be more appropriate. Sequential sampling is also an economic sampling tool that may be used advantageously to determine control effectiveness.

There was general agreement among the participants on the following statements:

1. At times we may demand a high level of control when a lower level would do an adequate job at a more economical cost.

2. We must take into consideration the effects of natural mortality factors on the insect pest species when we are contemplating control.

3. There is a possibility that in the case of chronic infestations we may compound the problem by changing the quality of the residual population from a less to a more vigorous one through direct control.

4. It is important to get good spray coverage assessment. If we don't get adequate control we need to know why.

5. We do have good enough survey techniques for some of our forest insect pests that enable us to relate insect populations to expected defoliation (blackheaded budworm and spruce budworm) and then we can predict the population reduction necessary to prevent undue loss.

6. We must keep in mind the economical values of the resources we are protecting. It is easier to figure the value of a resource such as timber or to calculate the dollar return on products that are close to being sold such as cone crops, downed trees, etc. We need values placed on non-timber resources.

7. Area useage is another important factor when establishing control levels. In some recreational areas we want to pick up every beetle infested tree and with defoliators we want to keep foliage on the trees.

To sum it all up, we can't generalize, but each case must be judged according to the available information and in the best judgment of the forest entomologist and the forest manager.

EVALUATION OF BARK BEETLES

By

Bill McCambridge

Three kinds of evaluation were suggested for consideration; vis., biological, economic and resource impact.

Biological evaluation is understood to be an appraisal of those measurable factors that affect beetle populations and a prognosis of infestation trend.

Methods

Black Hills beetles in ponderosa pine--Forest Service Region 2 uses the sequential sampling plan outlined by Knight. Adult beetles are counted in June and early July from two 6-inch by 6-inch bark samples taken from opposite sides of a minimum of 20 trees. The cumulative sum of beetles is fitted into the sequential plan to predict infestation trend. Region 2 feels the plan is very accurate, especially in predicting static and declining trends. In predicting increasing trends there is need for additional case histories. McCambridge feels the Black Hills beetle becomes epidemic when three ponderosa pine become infested in a group. If true, an evaluation at the time of adult development in these small groups must be refined to predict the rate of increase. Gearing detection to these small groups is in effect, looking over a green forest. Black Hills beetle biological evaluations in R-2 do not attempt to include counts of parasites and predators.

The biological evaluation of mountain pine beetles in lodgepole pine, in R-4 as reported by Bill Klein, is essentially the same as that used in ponderosa; vis., two 6-inch by 6-inch bark samples taken at breast height from each tree just before beetle flight. The number of adult beetles is counted as well as the number of parasites and predators. Up to this time evaluation of the parasite-predator data is not meaningful.

Engelmann spruce beetle population trends in standing spruce are determined in R-2 from sequential sampling of 6-inch by 6-inch bark samples. The procedure was outlined by Knight in 1960. The difficult problem with Engelmann spruce beetles is the evaluation of populations in scattered windthrow and logging slash. Dave Dyer has been engaged in this work in Canada for several years. He takes a one-half sq. ft. bark sample but reports that where and how to sample endemic populations is still in the developmental stage. Dave reported that spruce beetle populations in stumps are sometimes significant, while those developing in tops less than 6 inches are of doubtful importance in infestation buildup. In Colorado, there exists no satisfactory method of evaluating the importance of Engelmann spruce beetle populations in logging slash and windthrow.

General comments from the floor brought out the point that evaluations are complicated by such things as: rate of tree growth, rate of beetle attack and variations in beetle behavior. In regard to this latter it was mentioned that in the U.S., Douglas-fir beetles going from windthrow to standing trees resulted in a decrease in population. Atkins, and others have found brood density higher in standing trees than in logs. It was brought out that the location of the samples is important. McMullen finds most variation between samples when they are taken near the bottom of trees.

Some discussion was devoted to the question, "To how large an area of infestation do you apply the evaluation data when predicting trend?" At this point the group entered onto the shaky ground of speculation. The best we came up with was that trend prediction should cover those areas sampled which have similar site and stocking and fairly homogenous climatic conditions.

Atkins felt that the condition of the beetles may be of much greater importance than their numbers. He reported on his work with the Douglas-fir beetle where he found that beetles of low vigor; i.e., those with low fat content, respond to host material more readily than high vigor--high fat content beetles. Furthermore, broods produced under high intraspecific competition have lower fat content and such broods may scatter less upon emergence. Broods produced under high temperatures were also found to have lower fat content. The two events--high intraspecific competition and high developmental temperatures--have a cumulative effect on scatter and tend to decrease infestation trend, sometimes sharply. On the other hand, broods produced during endemics may tend to scatter widely upon emergence.

Atkins reported a direct relationship between the fat content of female Douglas-fir beetles and the number of eggs laid per inch of gallery. The relationship of fat content, egg production and infestation trend presents an interesting evaluation sequence. Between 1955-59, Knight studied nine Engelmann spruce beetle infestations: 3 endemic, 3 declining epidemics and 3 epidemics. He found eggs per inch of gallery associated with these conditions as: 8.5-9.8, 12.0-12.9 and 17.4-18.5 respectively.

This approach to biological evaluation certainly warrants additional attention.

<u>Economic and resource impact evaluations</u>

Both of these evaluations rely heavily on knowledge of histories of past outbreaks which are measures of destructive potential.

H. J. Heikkenen suggested an economic evaluation of Douglas-fir blowdown might not support radical, or large changes in logging plans. He contended the net annual loss be confined to the volume of wood lost due to peripheral deterioration. It was pointed out that this deterioration loss can be greatly complicated by insects such as ambrosia beetles which may add considerably to degrade. Since it is not possible to forecast subsequent loss, the land manager is reluctant to take a chance on leaving large volumes of blowdown in the woods.

Economic evaluations take on a different twist when considering spraying green trees to prevent beetle attack. It soon became apparent in the workshop that more and more of this type of work is being done. The statistical probability of a given tree being hit by beetles, even in the midst of most epidemics, is quite low. However, this probability takes on the same significance as encountered in drug testing. No company would be willing to manufacture a product with a .001 probability that their product would cause mortality. So the economic evaluations made with protection in mind, regardless of trend, take on the range of importance and emotion that home owners apply to shade trees in the yard. It is very likely that forest managers will come to apply protection in specific areas with equal frequency. Before legislation prevents the use of satisfactory repellents or attack preventing chemicals, we should give serious thought to educating the public to the need for preventive sprays. Fred Dickison hit this point in the initial plenary session and the need for public education and publicity has been mentioned repeatedly.

Following spectacular bark beetle outbreaks, studies are frequently made on the impact to the resource. These evaluations are building up a store of knowledge about the good and bad that forest destruction by beetles can and does produce. Coupled with these studies is the experience gained by carefully following the progress of lesser outbreaks. This knowledge should be at the ready call of all who must make economic evaluations prior to control. In the past, and not too distant past, scare tactics have sometimes been used in an attempt to elicit support for control. These tactics frequently project the possibility of future damage way out of proportion to what past experience has shown will happen. The fact that trees actually exist in these areas under attention would be common sense evidence that complete destruction does not take place. On the other hand, intensified use of forest resources does require an ever deepening awareness of the various facets of human interest that may be influenced by even slight damage to forest trees. Economic evaluations are not easy.

We can sum up by saying that as of 1965, there is still an urgent need to develop and improve biological evaluations for most bark beetles. Every step that adds to such evaluations will make the job of economic and resource impact evaluations that much easier, more accurate and more professional. The amount of data that can be put into computers is almost limitless. The only problems are: knowing what is significant data, how do we measure it, and have we left out significant information?

AERIAL SPRAY APPLICATIONS

By

A. D. Moore

One of the first assignments given the Insecticide Evaluation Project in Berkeley, after it was established in 1964, was the development of a selective, short-lived chemical treatment for control of spruce budworm.

To meet the immediate need for a treatment for this insect, we had to turn to chemicals in production or experimental chemicals near the production stage and to the basic application equipment and procedures developed for DDT. Chemicals in or near production are not truly specific for the budworm, as their insecticidal activity was discovered with other insects. Also, the methods of application developed for obtaining relatively heavy deposits on foliage leave equally heavy deposits on nontarget areas of the forest ecosystem. We believed, however, that a selective treatment could be developed if three conditions were met: (1) if an insecticide could be found that would be more toxic to the budworm than to other organisms, (2) if the parent insecticide and any active metabolites would be broken down in the forest ecosystem--thus, not build up in any plant or animal systems, and (3) if adequate changes could be made in existing application equipment and procedures to direct the spray to the budworm with a higher degree of efficiency than to other organisms.

A carbamate insecticide Zectran[R], a product of Dow Chemical Company, has shown the highest degree of selectivity for the budworm of any of the chemicals tested to date. It has a relatively high acute oral toxicity to mammals, but much lower dermal and chronic feeding toxicity --which are the main potential hazards in field use. It is much more toxic to the budworm than DDT, thus, can be used in much smaller quantities. The parent compound and main active metabolites are readily broken down by sunlight and in plant and animal systems.

All studies to date (including studies on fish and wildlife) indicate that this material meets conditions 1 and 2 above to a higher degree than the other candidate compounds now available and that it can be used effectively and safely in the field. This then brought us to condition number 3--the task of directing the spray to the target with greater efficiency than to other organisms.

It was first necessary to determine the most efficient mode of exposing budworm to an aerial spray. This proved to be direct contact of the spray drops with the larvae, with some possible added effect from droplets caught by the webbing surrounding these larvae. Foliage feeding is a very inefficient mode of exposure, and contact with surface deposits on the foliage does not appear to be much better.

By using fluorescent particles suspended in the spray, we determined the distribution of drops of different sizes on the budworm, its webbing, and on surrounding foliage. It was found that only the very small, airborne drops (below 50 microns in diameter) consistently reached the budworm larvae. By means of aerially released oil smokes (less than 1 micron particle size) and by following fine aerial sprays with Lidar (laser radar equipment developed by the Aerophysics group at the Stanford Research Institute), we found that these very small, airborne droplets can reach the tree crowns and the budworm larvae through atmospheric transport and diffusion. Further, that diffusion and thermal and physical turbulence near the forest canopy may have been unrecognized allies in past operations.

The U.S. Forest Service Equipment Development Center at Missoula, Montana is now adapting some of the basic components of existing spray equipment to produce drops less than 50 microns. The staff there has found that by mixing the insecticide solution with Freon under pressure, in a Stull bi-fluid nozzle they can produce drops of this size. As the Freon vaporizes on leaving the spray nozzle, it breaks up the spray drops with far greater efficiency than air shear alone.

In essence, the Equipment Center is trying to cut out that part of the drop spectra (more than 90 percent of the volume of most aerial sprays) that is least effective against the budworm but contributes heavily to environmental contamination.

We plan to use this equipment for a pilot test of an aerosol-type treatment with Zectran (probably at 0.03 lb. in 1/2 pt./acre) this summer.

Optimum use of atmospheric transport and diffusion will require advance information on flow patterns and temperature gradients for the drainages to be treated. And it will require three-dimensional observations or measurements of the aerosol plumes to correct for deviation from theoretical behavior.

The initial work is being carried out in mountainous terrain where we have the advantage of "sides" on the units to be treated.

A model of expected flow patterns is now being developed. Actual flow patterns in specific drainages will be checked by means of aerially released smoke trails and the behavior of small helium-filled balloons.

Preliminary observations indicate that temperature gradients will be one of the key parameters--and probably one of the best indicators of when and at what height the aerosol should be released in a particular drainage. Under inversion conditions, the main movement of small particles is laterally, while under lapse conditions the main movement is vertically. The smoke tests and Lidar studies made to date indicate that under the right conditions--for first getting lateral diffusion of the spray followed by downward vertical transport--it should be possible to treat large segments of some drainages with one pass of the spray plane; thus, saving valuable flight time.

A temperature probe and recorder mounted on a helicopter will be used with ground-based equipment for making vertical temperature soundings to determine thermal gradients.

Both the lines of flight and height of flight will be determined from the airflow and temperature gradient data.

The actual behavior of spray aerosols under different conditions in specific drainages will be checked by tracking spray plumes with Lidar equipment. This work will be carried out by personnel of the Stanford Research Institute with equipment they have adapted for this purpose.

We will not know how successfully this type of treatment can be used until these tests are completed.

BACILLUS THURINGIENSIS

By

Ralph F. Anderson

Although insect pest control involves the expenditure of about one-half billion dollars annually in the United States alone, only an insignificant portion of this outlay is for microbial insecticides. This is true despite the facts that insect diseases have been studied for well over a century and that control of insect pests by pathogens was advocated over fifty years ago.

Most of the more noxious insect pests have microbial pathogens associated with them in nature. About one thousand insect pathogens belonging to the fungi, viruses, protozoa, bacteria, or rickettsiae have been described. Microbial insect pathogens have potential for development into practical microbial insecticides because of their specificity, safety, and effectiveness against many economically important insects.

A biological control candidate needs certain prerequisites before it can be considered for practical field use. These qualities can be described as follows: The ideal agent should be highly virulent for the economic target insect and should be stable to stresses of nature in this characteristic. Its virulence should be confined to the species or group of insects which is being treated. The lethality should be rapid so that crop damage can be held to a minimum. The agent should not damage crops nor should it be harmful to beneficial insects, predators, and higher animals. The active principle should also be amenable to production in conventional industrial equipment by processes which are capable of yielding an economic product. The product should also be stable over an extended period so it can be stored and shipped to its site of eventual use. The bacterium, *Bacillus thuringiensis*, possesses these characteristics and is reportedly lethal to one hundred and thirty-seven insect species belonging to the Lepidoptera. It offers unique selective action against these insect pests with complete safety for man, animals, fish and birds as well as most of the beneficial insects.

One of the difficulties in mass producing THURICIDE[R] is the fact that there is no single distinct chemical entity produced which can be readily analyzed in the laboratory to determine the potency of batches coming off the production line. Thus, for quality control purposes three different species of Lepidoptera are used to assay each batch of THURICIDE several times during the processing to assure that it maintains its lethality for the insect targets. In addition, the usual measurements of acidity, solids content, spore count and crystal-to-spore ratio are determined for each batch of product.

There is no doubt that the potency of THURICIDE[R], as measured by bioassay in the laboratory, can be greatly increased, but we already have an abundance of data that indicates that getting the active ingredients (crystals, spores, and toxins) where they are needed, and then keeping them there, is more effective than merely increasing potency. The problem of stability and reproducibility has been solved - B. thuringiensis (THURICIDE[R]) now compares favorably with many of the chemicals in use today.

SEX ATTRACTANTS

By

D. L. Wood

A brief review of the current status of sex attractant research in North America was presented.

Identified and Synthesized Attractants

1. Gypsy Moth — *Porthetria dispar*
2. Pink Bollworm Moth — *Pectinophora gossypiella*
3. Cabbage Looper — *Trichoplusia ni*
4. Silkworm Moth — *Bombyx mori*
5. California 5-Spined Ips — *Ips confusus*

Current Identification Efforts with Forest Insects

Bark Beetles - (?) = Not verified

1. Smaller European Elm Bark Beetle, *Scolytus multistriatus*
   University of Wisconsin - D. M. Norris (?)

2. Striped Ambrosia Beetle, *Trypodendron lineatum*
   Douglas-fir beetle, *Dendroctonus pseudotsugae*
   Oregon State University - J. A. Rudinsky

3. Southern Pine Beetle, *D. frontalis*
   University of Georgia - R. T. Franklin, C. M. Himel, C. H. Tsao

4. Southern Pine Beetle, *D. frontalis*
   Boyce Thompson Institute for Plant Research
   Sour Lake, Texas - J. P. Vite

   Mountain Pine Beetle, *D. ponderosae*
   Boyce Thompson Institute for Plant Research
   Grass Valley, California - G. B. Pitman

5. Black Hills Beetle, *D. ponderosae*
   Engelmann Spruce Beetle, *D. obesus*
   Rocky Mountain Forest and Range Experiment Station
   U. S. Forest Service - N. D. Wygant and W. F. McCambridge, cooperating with R. M. Silverstein, Stanford Research Institute.

6. Western Pine Beetle, *D. brevicomis*
   University of California, D. L. Wood cooperating with R. M. Silverstein, Stanford Research Institute.

Other Insects

1. Spruce Budworm, Choristoneura fumiferana
   Forest Insect and Disease Laboratory
   Canada Department of Forestry with University of New Brunswick - D. R. Macdonald and J. A. Findlay.

2. Introduced Pine Sawfly, Diprion similis
   University of Wisconsin - H. C. Coppel

3. European Pine Shoot Moth, Rhyacionia buoliana
   Pacific Northwest Forest and Range Experiment Station
   U. S. Forest Service

4. Douglas-fir Tussock Moth, Hemerocampa pseudotsugata
   White-fir Sawfly, Neodiprion abietis
   University of California, D. L. Wood cooperating with R. M. Silverstein, Stanford Research Institute.

I know of no successful control programs where either synthetic or natural attractants produced by insects have been used.

Isolation and Identification of the Ips confusus sex-attractant - Recent Progress (With R. M. Silverstein, Stanford Research Institute).

Three terpene alcohols, which we believe to be the principal attractant components in male frass, were isolated, identified and synthesized. They are: Compound I, (-)-2-methyl-6-methylene-7-octen-4-ol; compound II, (+)-cis-verbenol; and compound III, (+)-2-methyl-6-methylene-2, 7-octadien-4-ol. In the laboratory I + II, I + III and I + II + III evoke the attractant response, while in the field only I + III and I + II + III attracted I. confusus. The ternary mixture was the most potent. Compound I and I + II attracted I. latidens in both the field and laboratory bioassay. However, compound III blocked or masked the attractant for I. latidens in the laboratory. Blocking of a synergistic system, as revealed in these studies, offers a new and intriguing control possibility. Intensive field evaluation of the synthetic materials are planned for this spring.

The use of attractants in combination with insecticides, chemosterilants and radiation was briefly discussed. Because many bark beetle species must congregate or mass attack before they can kill the host and reproduce, their control may be particularly amenable to the use of attractants as agents of confusion. The application of these materials during the flight period may sufficiently dilute the mass attack to prevent the death of the tree and disperse the population over a large area.

Specificity of Bark Beetle Attractants

The specificity of attractants produced by species of *Ips* in Hopping's subgeneric groups I and IX has been established under laboratory and field conditions. The grass of the species within each group evokes the attractant response from other species within that same group. However, when presented simultaneously, a species is more responsive to its own frass than that of a closely related species. Females of *I. confusus* will join the male galleries of *I. hoppingi* and *montanus* in the field. *I. lecontei*, *montanus* and *hoppingi* are all responsive to *I. confusus* synthetic attractants in the laboratory, but at different combinations and higher levels.

BIOLOGICAL CONTROL

A Nuclear Polyhedrosis Virus as a Control Agent for the Douglas-fir Tussock Moth

By

C. G. Thompson

The virus which causes nuclear polyhedrosis in the Douglas-fir tussock moth, Hemerocampa pseudotsugata Mc.D. may be extremely useful in the control of this forest insect pest. The virus may be of considerable importance in both natural and applied control.

The history of tussock moth outbreaks indicates that, in the absence of chemical control measures, the outbreaks are eventually terminated by epizootics of polyhedrosis. While the epizootics usually result in near eradication of the tussock moth, severe defoliation and tree mortality occur before the virus disease becomes effective. In addition, it is probable that the more specific insect parasites and predators also almost vanish in the absence of the host following an epizootic. This results in cycles of tussock moth outbreaks with either feast or famine resulting for natural control agents.

Our laboratory and simulated field tests have indicated that aerial applications of the virus can effectively introduce the virus into tussock moth populations before the virus appears naturally. It is probable that most of the new flush of foliage would be lost before the disease becomes effective. This damage could probably be tolerated the first year of the outbreak but may be critical if it follows several years of heavy defoliation. It is to be expected that the cyclic nature of tussock moth outbreaks would not be greatly effected by an artificial application of the virus.

While we are actively planning an operational-type field test, I believe we should also be more intensively integrating natural control, biological control (applied), and chemical control. It is quite possible that with judicious manipulation of these three types of control we could, with an occasional assist by man, maintain a tolerable level of tussock moth infestation without developing the feast or famine situation that now results from natural virus epizootics or from applied control measures.

We pay lip service to the idea of integrated control but we do little in the way of organized research to see if it is possible. Before we can accomplish much more, I believe we will have to integrate our research. It seems to me that specialists in a multitude of fields will have to concentrate on a specific insect. This will involve not only insect pathology, but classical biological control, chemical control, population dynamics, insect biology and ecology, survey and detection, forest management, safety for fish and wildlife, safety for people and aesthetic values.

PREDATORS OF THE BALSAM WOOLLY APHID

By

R. G. Mitchell

A program has been underway since 1957 to control the balsam woolly aphid (*Adelges piceae*) in Oregon and Washington by introducing insect predators from foreign lands. Twenty-three species have been introduced from 7 countries throughout the world. Five species from Europe have become established: Three species of flies, *Aphidoletes thompsoni*, *Cremifania nigrocellulata*, and *Leucopis obscura* and two species of beetles, *Laricobius erichsonii* and *Pullus impexus*. They all prey on the woolly aphid but so far have not sufficiently reduced populations to prevent tree killing. Reasons for their failure include poor symchronization of predator-prey seasonal habits and inadequate searching ability of the predators. But the extreme sensitiveness of the host trees is believed to be the key to the balsam woolly aphid problem in North America and the confounding factor in the biological control program. Like other imports, the balsam woolly aphid has a new environment which permit populations to grow nearly unchecked. But the aphid is also much more destructive to its new hosts than it is to its native European hosts. It appears that even if North American aphid populations were held to the levels found in Europe, severe tree damage would still occur.

BIOLOGICAL CONTROL OF THE LARCH CASEBEARER

By

Robert E. Denton

Since its discovery in Idaho in 1957, the larch casebearer has rapidly become the second most important defoliator in the Northern Region--second only to the spruce budworm. After 10 years, it infests more than three-fourths of the western larch type in Region One, and it seems obvious that the casebearer is not going to rest until it finds every larch tree within the botanical range of western larch. Although no tree mortality has shown up yet, smaller trees have been defoliated to the point where they are not putting on any radial growth.

Of course, the foremost problem is how to check the casebearer and bring the epidemic under control. The problem is difficult because of the fantastic casebearer population that has built up in the absence of natural controls. We have tested and can recommend a method of chemical control (low-volume application of technical grade malathion at 8 fluid ounces per acre), but artificial control would be very costly because of the scattered nature of larch in many of our stands.

Instead of chemical control, we are putting our long-range hopes on biological control by an effective primary parasite, Agathis pumila. This European braconid was introduced into the East during the 1930's and is credited with actually checking and controlling larch casebearer infestations. It has one generation a year, a biotic potential of about 80 eggs per female, and its only host is the larch casebearer.

Our success so far is very encouraging. The original release of Agathis was made in 1960, when 2400 adults were shipped to us by the New Haven, Connecticut, Laboratory. These were released in lots of about 400 in 5 locations of heavy infestation. In one locality, starting with only 200 females, 6 years later in 1966 we reared 1900 Agathis from 11,000 casebearers, which equals 17 percent parasitism. This is actually a tremendous increase in total number of parasites in the area. Unfortunately, there has been little spread of Agathis because of the huge immediate host population available. An interesting development concerns our original plan to be able to study the effects of a single parasite upon its host. A few years ago, native parasitism was practically nonexistent. In 1966, a combination of chalcids, braconids, and ichneumonids totaled 10 percent in areas of oldest infestation. So native parasites are beginning to find the larch casebearer a suitable host.

In 1964, we began our own large-scale rearing program. In that year, we reared 10,000 Agathis on larch trees transplanted into large cages. To get the operation started, we figured that these 10,000 parasites cost one dollar apiece. The following year, we reared 30,000 Agathis at half that cost. From this latter rearing we estimated 260,000 progeny, a large portion of which were kept captive by releasing them on larch trees caged with fine-mesh cheesecloth. There are some problems to be solved concerning the caged-tree method of rearing parasites. This past year we were unsuccessful because we suspect that temperatures got too high inside the cheesecloth cages.

To date we have distributed Agathis in lots of about 5,000 in 52 locations, and we plan to continue this program for several years. It will take many years for the parasite to build up to the point where it will exert significant control, but eventually we hope that biological control of the larch casebearer will be accomplished.

PROBLEMS IN BIOLOGICAL CONTROL WITH PARASITES AND PREDATORS

By

Roger Ryan

The biological control of many of our forest insects presents many interesting problems. For many years biologists thought of biological control only in the classical sense, that is, to go to the country of origin of an exotic noxious insect and then send the natural enemies back home for quarantine, rearing and eventually release in the infestation area. Biological control, however, can also be practiced against indigenous insects through releasing reared natural enemies, as with exotic pests, but there are many other possibilities such as augmentation and conservation of natural enemies. The broader definition of biological control is particularly pertinent in California's forests as almost all of the important destructive insects are native.

Studies on the natural enemies of several important forest insects (bark beetles as well as defoliators) in California have been under way for several years. The role of insectivorous birds in the population dynamics of these noxious insects has been considered in some detail. Although there are a number of birds feeding on insects in the forest, the hole-nesting or bark-foraging component of the avifauna lends itself to study more readily than the other birds. The ubiquitous chickadees were chosen as a starting point in this study because of the many reports fromEuropean countries of the importance of closely related birds in the family Paridae.

The diversified forest is known to be one means of encouraging birds. In highly managed forests or plantations there may not be enough natural nesting sites for the hole-inhabiting species. Nesting boxes can provide another means of encouragement for the hole nesters.

Nest box plots have been established in two areas in California, one in the white fir-Jeffrey pine type to study the mountain chickadee (*Parus gambeli*) and the other on the coast in a Christmas tree plantation to study the chestnut-backed chickadee (*Parus rufescens*). The objective of this research is to investigate the biology and the seasonal feeding habits of the chickadees and to see if the number of nesting pairs per acre can be increased by providing nesting sites. Birds are known to be inverse density dependent factors and their role at low or moderate prey levels is said by many to be quite important. Several European investigators actually have evidence to show that by providing nesting boxes they have prevented noxious insect outbreaks.

The first-year results in California were both encouraging and discouraging. In the five plots (50 nest boxes per plot) in the second growth white fir-Jeffrey pine type a phenomenal average chickadee occupancy of 46.4% was recorded. A nest box occupancy rate of 15 to 20 percent is thought to be good in the first year. A total of 686 eggs were laid (5.97/nest) and 572 mountain chickadees were fledged (4.93/nest). The chestnut-backed chickadees in the plantation only occupied 3 of 50 nesting boxes. This was lower than expected but not too surprising when considering the simplified or nondiversified environment of a plantation.

Aspects that will be investigated in the future include a determination of the best type of nesting box and the optimum nest box spacing to increase the number of breeding chickadee pairs in an area. The successful demonstration of such a bird encouragement program may lead to an entirely different approach to forest insect control. The forest manager of the future may think in terms of destructive insect population levels far below those levels at which control decisions are made today.

CHEMICAL FERTILIZERS TO COMBAT THE BALSAM WOOLLY APHID

By

J. R. Carrow

A study of the effects of altering the nutrition of the host tree, *Abies amabilis*, on the balsam woolly aphid, *Adelges piceae*, revealed several interesting features. The establishment rate of aphids on host trees grown on a humic, nitrogen-rich soil was 2.5 times as high as on host trees grown on a mineral, nitrogen-poor soil. In addition, the rate of growth of the aphid population on humic soil trees was considerably higher than on mineral soil trees.

Treatment of the infested trees with urea and ammonium nitrate solutions, applied to the foliage, resulted in various responses in the aphid population. On trees receiving a 1% NH_4NO_3 treatment, the aphid population level decreased considerably, while populations on trees receiving all other treatments, and on control trees, exhibited a marked increase. This decline in the population can be attributed to a greatly decreased settling rate of the crawlers on the host trees. A possibility exists that changes in the composition of the feeding tissue in the host trees are responsible for the adverse effect on the aphids. Analysis of bark tissue from the host trees revealed that an amino acid imbalance may have been induced by fertilization with 1% NH_4NO_3.

REMOTE SENSING

By

Bob Heller
John Wear
James Lindsay

We first tried to bring everyone up to speed on what remote sensing is, who is doing it, and how it is organized. Remote sensing might be defined as a detection of objects by sensors remotely located from the object of interest. Sensing implies human attributes of feel, taste, smell, hearing and sight. We are dealing with only the last sense--sight. Reference was made to the electromagnetic spectrum to identify the fact that matter reflects, scatters, absorbs, transmits, and emits energy differently; and is dependent on the molecular and atomic structure of the object itself. For insect damage detection we have relied mostly on the visible and the photo-infrared portion of the electromagnetic spectrum. Because of the great improvements in color and infrared color films since 1962, we believe that forest entomologists will continue to rely on these sensing media for some time to come. Examples were shown of sensing in other portions of the electromagnetic spectrum; viz, the thermal and radar portions.

All remote sensing research in forestry is being centered at the Pacific Southwest Station. It is a cooperative project with the University of California and the Pacific Southwest Forest and Range Experiment Station. We are getting funds from Forest Insect Research, Forest Economics and Marketing Research, Forest Insect and Disease Control, and from NASA (National Aeronautics and Space Administration). Professor Robert N. Colwell is Chief of the Forestry Remote Sensing Laboratory and offers technical guidance to the entire project. There is a counterpart unit at Purdue University for remote sensing in agriculture. The Pacific Southwest unit has nationwide responsibility; we can work on your problems if you let us know what they are.

John Wear demonstrated the relationships between aerial photographic and ground surveys which have been developed in the Pacific Northwest for making insect damage appraisal surveys. With his past experience on aerial photo and ground costs and the comparative accuracies of photo interpretation, he was able to demonstrate three options available to a prospective user of aerial photographic techniques. Wear pointed out that the number of aerial photo to ground plots can be selected for (1) best efficiency, (2) for a fixed or chosen sampling error, and (3) for a fixed budget that can be spent on making a survey.

Heller discussed the studying being conducted on damage by the Black Hills beetle on ponderosa pine in South Dakota. This is a cooperative study with NASA, the Rocky Mountain and Pacific Southwest Stations. We are attempting to detect infested trees before visible foliage symptoms can be seen on the ground. It involves a great deal of tree physiology work which has been carried out by F. P. Weber who is attached to our project but is presently working at the University of Michigan. In addition to taking color and infrared color photographs of the infested trees, Stanley Hirsch's fire detection group from the Intermountain Station at Missoula have been taking optical-mechanical scanning imagery in an attempt to detect foliage temperature differences. To date infrared color film has not detected fading trees any earlier than regular color film, and neither one has detected the dying trees before they could be visibly seen on the ground. To date the resolution of the thermal imagery has not been sufficiently good to identify individual trees; however, improvements are expected this season.

Wear reported on the successful use of a helicopter platform to plot Douglas-fir beetle infestations in Oregon over a 50,000 acre area. Wear also showed pictures of his foliage sampling pole pruner which can be used from a hovering helicopter. This technique has generated a lot of enthusiasm from forest pathologists and entomologists for sampling insect populations and disease symptoms. A pressurized paint spraying device was also discussed; this device is used from a helicopter to mark the corners of spray units in large aerial spraying operations. There are publications available on these two devices which can be obtained from the Pacific Southwest and Pacific Northwest Stations.

A 35 mm aerial photographic system was described in one of the plenary sessions and also during the panel discussion on remote sensing. This system was developed by James B. Lindsay who is a practicing geologist and does consulting work out of Salt Lake City, Utah. He developed this system to reduce the amount of field work required to check mineral deposits; he feels he can cover a great deal more ground and make his field work more productive by taking 35 mm color photography for stereo examination. As forest insect and disease specialists, we are very interested in the advantages of this system.

The photographic system that Lindsay used in a Cessna 180 is as follows: The camera is an electrically actuated Robot Star which recycles up to 4 frames per second and has a shutter speed of 1/500th of a second. Many lenses can be adapted to this camera, but the one used by Lindsay has a focal length of about 1 inch. The camera is suspended by four cables in a specially built mount to overcome aircraft vibration. For geologic mapping the plane is flown about 5000 feet above mean terrain elevation;

this produces a scale of about 1:60,000. Kodachrome II film is used in most operations; one advantage in using this film is that it can be readily processed by local Kodak processors in a short period of time. Pictures are taken rapidly enough to provide about 80 percent overlap along each flight line.

The plotting equipment consists of two matched Kodak carousel projectors which can be advanced, focused and reversed from the plotting position of the interpreter. A large sheet of Cronaflex translucent material onto which sufficient ground detail is premarked is attached to a near vertical glass plate. The processed 35 mm slides are then inserted in each of the carousel magazines so that the first picture would be put on the left projector, the second picture on the right projector, the third on the left projector, etc. The corrections for tip, tilt, and tip can all be corrected from the interpreters seat where a console is located. The color images projected onto the Cronaflex material are viewed with a Kail mirror stereoscope. The plotting board can be moved in either an X or a Y direction to permit orientation with the stereo pair being observed. It is quite an ingenious system and permits quite accurate plotting of data onto a base map.

Mr. Lindsay said the price of the camera equipment installed in the airplane was about $1,500.00 and the cost to produce the plotter was about $3,000.00. He estimated the cost per mile of flight line photography at $1.25 to $5.00 per mile, dependent on scale. This method could undoubtedly be used for locating and mapping large infestations of bark beetles as it is presently conceived. For detecting small groups of dying trees or defoliator infestations at an early stage, larger scales of photography would be required. This is a good example of another discipline--geology--using color aerial photography to good advantage.

It was brought to the attention of the conference that John Wear is assigned 20% of his time in research and 80% of his time toward helping Regions 1 through 6 in conducting administrative studies and providing liaison between research and Division of Forest Insect and Disease Control. The Remote Sensing Laboratory at Berkeley welcomes your inquiries and requests for assistance in doing research studies or assisting you in administrative studies for making detection and evaluation surveys. We would appreciate hearing of your needs as early in the season as possible--preferably January or February.

Royce Cox, Potlatch Forest Industries, showed slides on the mountain pine beetle attractant studies being undertaken by Boyce Thompson Institute. These studies involve remote sensing by the mountain pine beetle--not by our group at Berkeley.

ARTIFICIAL DIETS

By

Harold W. Flake, Jr.

This was the first Work Conference at which artificial diets for forest pests were discussed. Twelve members were in attendance at the workshop. Of the members present, about half had used or were using artificial diets and the other members were primarily interested in possible future needs. Of the members present who had used artificial diets, the majority has worked with defoliators.

When rearing defoliators it was noted by several workers, the number of instars may vary from the considered normal. The Douglas-fir tussock moth usually has less and the spruce budworm frequently has more instars. The development rate for defoliators was usually faster with media-fed larvae. Insect larvae which are successfully reared on artificial diets are usually larger than their counterparts reared on host foliage. No work on the comparative reproduction rates of media-fed and host-fed larvae was reported.

The bioassay of insect pathogens, insecticides and sex attractants was the primary use for insects reared on artificial diets. Laboratory reared Douglas-fir tussock moth larvae are also being used to provide a source of material for the isolation of its sex attractants.

It was reported that a dose of virus on media is more effective than an equal dose on foliage when using the Douglas-fir tussock moth and its associated virus. The exact relationship is not known but it was suggested that the media may retain more of the virus.

Limited bioassay test of chemical toxicants indicate microgram per gram of body weight of the toxicant remains the same when media-fed and foliage-fed tussock moth larvae are compared.

In the bioassay of sex attractants with media-fed insects, it was felt not enough had been done or was known to draw any conclusions.

It was suggested that by using artificial diets, better experimental control could be maintained by removing the variability of the host foliage throughout the year. Also better environmental conditions could be maintained.

Acceptance of an artificial diet varies even between closely related species. Incorporation of ground host foliage may be of some value, but some insects refuse to feed even when it approaches 100 percent. It was reported that insects usually prefer the food source on which they were first placed. Insects which were reared for several instars on artificial media did not readily make the transition to their host food source. A possible explanation given was the muscular and mouthparts were not sufficiently developed to handle the host foliage.

Several techniques were discussed which are useful when using artificial media. Eosine red dye had been used to color the media and may be useful in marking insects which have fed on it. A thin paraffin wax coating can be used to prevent the media from readily drying out and hold down contamination by non-pathogenic organisms. The paraffin coating also provides a better substrate for the insect to move about on and may reduce early instar mortality. A small amount of bees-wax will prevent the paraffin from cracking readily. Small "lolly-pop" molds for media have been used and may have numerous applications. After the media is removed from the mold it can be coated with paraffin and used.

Several recommendations were expressed at this workshop:

1. A listing of insect cultures and diets used should be maintained annually for both the United States and Canada.

2. In future years alternate, a general session on artificial diets with either specific workshops on bark beetles or defoliators diets.

3. Develop communication channels to readily make rearing information available.

EVALUATION OF DEFOLIATORS

By

Dave Crosby

Two broad conclusions soon presented themselves to the workshop, namely; to achieve meaningful results, we needed two weeks rather than two hours; and much more research is needed even on those insects which have been studied extensively; with distressing frequency we heard ourselves saying, "We just do not know enough about the insect involved nor its effects on the host tree."

The specific points covered in discussion are summarized below.

Ideas brought forward.

1. What is the tolerance of the host tree for the insect considered; for example, the red-headed pin sawfly in the Lake States.

2. There is a need to follow insects through various population levels. Spruce budworm with 40 eggs per cluster may drop to 28. Why this decrease? What is the significance? Comes back again and again. You have got to know your insect.

   Possibly an outbreak will decline from natural causes. This we should know about a problem insect in outbreak status.

3. What are the economic levels involved? How much loss can be tolerated before it becomes economically advisable to control? It may cost $200,000 to spray where the stumpage is worth only $250,000, but the value of the finished product may be seven times stumpage value. We are protecting the economy as well as the stumpage.

4. For six or seven of our forest insect pests such as the spruce budworm and the mountain pine beetle, we have developed satisfactory sampling techniques for biological and economic evaluations. We must develop similar guidelines for all our important insects if we are to give the forest land manager the information he needs in managing his stands.

5. Should we hand the woods manager apparently sound survey techniques which have not been scientifically established. For example, qualified entomologist working on Queen Charlotte Island, B. C., found that a lepidopterous defoliator was normally observed at the rate of six moths per chain under moderate outbreak conditions, but a count of 15-20 moths per chain was followed by a sharp increase in insect numbers to epidemic proportions.

6. Greater use of light traps in detection survey was recommended by the group since analysis of light trap data could reveal

instability in a population and thereby indicate significant changes in trends. It was pointed out here that with some insects, males and females differed in their response to light traps. Again precise knowledge about the insect involved is essential in developing reliable sampling techniques.

7. Discussion brought forth the opinion that in most instances we have been handicapped by having our research men placed on a problem only after the outbreak stage had been reached and by having them removed from a problem as soon as the outbreak subsided. In short, we did not have the opportunity to study a problem insect under endemic, increasing, or decreasing conditions but only when glaring outbreak conditions stimulated funding for research by the legislatures involved. Our research entomologists are prone to admire the Canadian system under which research men with more stable financing have been able to study an insect under both endemic and outbreak conditions. The current Canadian practice of dividing their research staff into three groups ranging from the man on basic, pure research to the "smoke-jumper" type available to assist the land manager with immediate problems has much to commend it.

8. A plea was made for less sophisticated survey methods for the use of the field man, particularly for use with the European pine shoot moth in the Pacific Northwest.

9. The importance of adequate training of woods personnel in detecting and reporting insect and disease conditions was stressed. In British Columbia special efforts to educate foresters in forest insect and disease conditions have been quite successful and these foresters constitute a very significant part of the Forest Pest Action Councils. It was reported that in California 50 percent of the graduating foresters had no training in forest entomology and pathology. In Oregon and Washington, one-week training sessions are conducted by the United States Forest Service in the eastern and western parts of each state. These training sessions are considered quite successful.

USE OF PARASITES IN FOREST INSECT CONTROL

By

R. B. Ryan

One of the fundamental tenets of biological control is that, in general, parasites contribute to the regulation of their hosts at average levels which are lower than would be maintained in the absence of parasites. It is clear, then, that parasites are valuable and should be encouraged if possible. Of course, some species are more efficient; i.e., are able to regulate host populations at lower levels, than others. If we wish to take advantage of parasites we must appreciate their mode of action and be willing to provide their needs. We must realize two important points regarding the role and action of parasites and the significance of these to our forest management decisions. First, parasite effect is maximum at high host densities and minimum at low host densities. Therefore, if we consistently maintain host (= pest) populations at low levels through such means as chemical sprays, it must follow that effect of the parasites present will be reduced. Second, the maximum effect of parasites is associated with increases in numbers following increases in host numbers. Therefore, a time delay in involved.

If parasites and other factors do not regulate pest populations low enough to suit us, or if they allow the pest to become temporarily too numerous, we have several courses of action open to us. We may introduce another mortality factor (introduction) or encourage the ones which are already present (conservation, promotion, and augmentation). These alternatives were discussed by workshop participants.

1. <u>Introduction</u> - an attempt to colonize parasite species not already present in order to add to the degree of natural control of a pest. This method should be foremost in the case of introduced pests. Opinion, however, was divided among workshop members as to whether single- or multiple-species introduction would be most advantageous and whether or not any more species should be added to existing parasite complexes of native or introduced insects. The opposing views stem from the observation that some better parasites are discriminated against by some inferior parasites in cases of competition, notably multiple parasitism. In spite of many instances of improved control, no case in known where host regulation was at a higher level after than before the introduction of a primary parasite. Even so, it must be recorded that the majority of the workshop participants, fearful of possible harmful effects resulting from the introduction of the wrong species of parasite, favored a "go-slow" attitude. A specific example of this thinking is the case of introduction of larch casebearer parasites into Idaho.

2. Conservation - an attempt to avoid inadvertent killing of parasite individuals during pest suppression efforts or regular management practices. Treatments which reduce pest numbers while at the same time are least destructive to parasites should be used when possible so that unfavorable pest-natural enemy ratios will not result. Methods of accomplishing this were discussed, such as the use of pathogens instead of insecticides, reducing dosages of insecticides, using insecticides with less residual action and exempting from treatment those areas harboring known relatively high natural enemy populations. Workshop participants were pleased with the progress toward selective treatments being made by insect pathologists and by the insecticide evaluation project. Also the decision in California not to spray stumps known to harbor high clerid populations was noted with approval. There was a general consensus among participants that untreated areas are necessary to serve as parasite reservoirs. Some felt that this is being adequately done, others did not.

3. Promotion - an attempt to modify the environment in order to favor the natural increase of parasites which are present. This can be accomplished primarily through the provision of essential requisites which may be continuously or periodically in short supply and limiting parasite effectiveness to below potential levels. Of all the requisites of a parasite, a supply of hosts is frequently a limiting one. Some workshop members felt that periodic local annihilation or near annihilation of hosts leading to the elimination of natural control factors was responsible for the extremely wide fluctuations characteristic of some pests. In this regard the periods between abundance peaks of the pest assume the dominant role. Specific examples of agricultural pests substantiate the fact that in certain instances peaks of pest abundance can be substantially reduced by fostering or actually liberating the pest in periods of scarcity in order to provide a continuous supply of hosts. Although workshop members agreed that more studies of forest pests with this in mind would be invaluable, we should be aware that the "kill every last bug" philosophy may not be the best in all cases.

   Of course, many parasites are able to maintain themselves on alternate hosts provided they are available. Diversification of tree species and encouragement of understory vegetation is one way to encourage alternate hosts. Another requisite of some adult parasites is food for the adults. It may be feasible in certain cases such as intensively managed plantations to provide food by encouraging or planting certain flowering plants.

4. <u>Augmentation</u> - An attempt to artificially increase parasite numbers or to modify the genetics of established parasite populations by field releases of parasites. Workshop members agreed that, although technically possible, the opportunity to use either inundative or inoculative releases to increase parasite numbers is prohibited in most cases by economic considerations, with the possible exception of specific pests in high value recreation areas. The attempt to modify the genetics of an introduced larch sawfly parasite by release of a strain less prone to encapsulation than the existing strain was noted with interest by workshop members.

(The ideas and proceedings of the workshop did not necessarily develop in the order as presented above but were organized by the moderator for the sake of clarity and continuity. Any ommissions or misrepresentations have been unintentional.)

INSECT CONTROL EQUIPMENT

By

Donn Cahill

Eleven members attended the workshop, and many contributed to the discussion of insect-control equipment.

In reviewing recent Ultra-Low-Volume spray projects, weather and aircraft spray equipment seemed to be the greatest deterrents to a successful project. The equipment was discussed at some length.

The equipment was the standard aircraft spray system, which was modified for U.L.V. application. This was done by returning more insecticide to the tanks, or intake side of the pump. Another modification was a 1/4-inch-bleed line from the pump and boom ends dumping back into the tank.

Some of the problems in Ultra-Low-Volume spraying were:

1. Calibration

    a. Measuring flow rates, both on the ground and in the air.

    b. Determining aircraft speed.

2. Pumps

    a. Present pumps were designed for large volume and low pressure whereas the U.L.V. requires higher pressure and less volume.

    b. Improve pump system to shut off boom pressure when not spraying.

3. Operation

    a. Difficulty in determining coverage because of low volume and fine atomization.

Some of the improvements suggested were: low volume and high pressure pumps and a metering system in aircraft to show application time and gallons used.

Dr. Bohdan Maksymiuk gave his concept for a quick-attachable helicopter spray system for microbial insecticides. His requirements are:

1. Suitable for keeping pathogen in suspension to deliver uniform dose.

2. Free of chemical insecticide residues.

3. Corrosion resistant, suitable for chemical sterilization.

He mentioned that spray systems should be adjustable for coverage of different pathogens, forest canopy and insects.

Dr. Moore and others outlined the 1967 Zectran spray project against spruce budworm. On this project three different aircraft (helicopter, Cessna 185 and DC-3) will be used to determine each one's effectiveness.

The application will be Ultra-Low-Volume, and all droplets will be below 50 microns in size, with a MMD (mass median diameter) near 20 microns. This small droplet spectrum will be produced by using bifluid nozzles, and mixing insecticides with liquified Freon 12. When droplets are released into the atmosphere, the liquified gas expands and becomes a vapor, scattering the parent droplet into many smaller droplets.

There was a short discussion on marking swaths and boundaries for aerial projects by using paints, cloth, and paper strips.

The ground control equipment was very briefly discussed. It was suggested that a spray boom be mounted on a truck, with all the operational controls inside the truck cab. This would protect the applicator from contacting the insecticide.

I would like to thank the attending members, and I hope that this covers the main points of discussion.

ADP AND ITS USE IN FOREST ENTOMOLOGY

By

C. J. DeMars

There appeared to be six broad areas in which automatic data processing (ADP) may be applied to forest entomology:

1. INVENTORY of entomological and ecological characteristics of unit areas of the forest. The main example is the work of the Canadian Insect Survey program in Ottawa, which Brown described. In this system the information is stored by geographic point, host-tree species, and insect species. The entomological information includes how many and what stage, as well as the species identification. The computer language COBOL is used. A FORTRAN IV language system MIADS2, written by E. L. Amidon (U.S. Forest Service, Berkeley, California) was also discussed.

2. COMPILATION AND DATA EDITING programs. Most of these perform basically simple operations, such as adjusting counts to the same sample unit size or estimating values for missing plots. They prepare the data in a form suitable for analysis by generalized statistical programs held in most computer center libraries. These editing programs are relatively simply to write and generally must be specific for each particular kind of data. Such programs can list the data, print tables, punch cards, and calculate sample means and variances.

3. STATISTICAL ANALYSIS of the data encompasses everything beyond the calculation of simple sample statistics. Generalized analysis of variance (ANOVA) programs are numerous. BIMED, BC-ANV, and STATPAK are examples. More specialized ones such as RADUNC and RADII provide more complete output, but their use is limited to specific models. The debate continues as to whether it is better to labor through the jargon of a generalized program or to write your own program for your particular requirements. Regression and multiple regression programs are held by all computer libraries. The University of California Library has a factor analysis program, BC-TRY, which may be helpful in "fishing expeditions."

4. MATHEMATICAL MODELING and SIMULATION of biological processes attracts an increasing number of forest entomologists, particularly those concerned with population work. The work of Watt and Holling is well known. Other simulation studies have been conducted by Berryman on the sterile male technique and Bill Miller and DeMars on sampling. Berryman and Miller have life table generation programs. Berryman reported on a model he is developing to explain competition in some bark beetle broods.

5. DOCUMENT storage and retrieval at the U.S. Forest Service Forest and Range Experiment Station, Berkeley, was discussed by DeMars. Citations can be retrieved by author, journal, title, and key words. An alphabetical list by author and by author within subject category can be kept up to date. Costs are still high--about $10 to sort through 1,000 citations for two key words. Dr. Richard H. Foote at the U.S. National Museum is heading up a study within the Entomological Society of America on automated information retrieval.

6. MANUSCRIPT preparation may be done by the IRMA program. This system allows the initial manuscript to be prepared in slightly more than the time to type a first draft. Thereafter, no typing or punching effort is required except on corrections. It cost about $16 (of computer time) per copy for an original manuscript of 200 pages. The final draft can be produced at the same computer cost, but at this time nine copies can be requested, averaging less than $2 per copy.

There appears to be an extreme communications problem between those doing ADP work in forest entomology. The publication status of computer programs is not clear. How are they to be reviewed? Should they be published in full or as a short paper with full listing to be supplied by the author upon request?

The best way of handling communication regarding who is programming appeared to be to publish notes in the Canadian Bi-Monthly Research Notes and in the U.S. periodic progress reports.

The question of programming training was discussed. Berryman indicated that training for biologists in programming seems to be linked to study programs in SYSTEMS ECOLOGY.

A consideration of the need for computer access by research and survey-control personnel led to no firm recommendations. DeMars suggested that each project have someone competent in programming who can check out the other personnel in how to set up specific programs--how to code the data, set up the control data cards and the machine job control cards--and then each man can do his own routine input-output. This would be preferable to having everyone invest the amount of time necessary to become programmers.

MINUTES OF FINAL BUSINESS MEETING

March 3, 1967

The Chairman, Richard Washburn, called the meeting to order at 9:45 a.m.

Minutes

The minutes of the initial business meeting were read and approved on a motion by David Crosby and John Schenk.

1969 Meeting Place

The Chairman opened the meeting for a discussion of the location for the 1969 meeting. H. J. Heikkenen extended an invitation to meet in Seattle. Don Schmiege extended an invitation to meet at Juneau, Alaska.

Ron Stark moved that we hold the 1969 meeting in Alaska. It was seconded by Jim Lowe. Motion was carried 25 to 10.

Theme, 1968 Meeting

A discussion was held on the Theme for the 1968 meeting. After a lively discussion it was moved by Ron Stark and seconded by Ken Graham that the Program Chairman be instructed to select a Theme which would cover the discussion on the floor. It was so ordered.

Committee on Common Names of Western Forest Insects

David Evans reported for the Common Names Committee and placed his report on file with the secretary.

Report on Nominating Committee

Donn Cahill reported that the Nominating Committee had selected John Chansler as the new member of the Executive Committee replacing Frank Yasinski.

David McComb and E. Dyer moved that nominations be closed. Norm Johnson and Donn Cahill moved that a unanimous ballot be cast for John Chansler as 1967 member of the Executive Committee.

Report on Ethical Practices Committee

Howard Trip reported on findings of Ethical Practices Committee. Don Dahlsten, Maxine Minnoch, Alan Berryman, and Ken Graham were all favorably considered but Ken Graham was selected as the new Chairman because of his continual outstanding efforts to deteriorate himself for this office.

C. J. DeMars and Norm Johnson moved that the members in attendance extend their thanks to the Local Arrangements Committee, the Program Committee and that the meeting be adjourned.

The Chairman adjourned the 18th Annual Forest Insect Work Conference at 10:45 a.m.

MINUTES OF EXECUTIVE COMMITTEE MEETING

February 27, 1967

The meeting was called to order by the Chairman, Richard Washburn, at 8:30 p.m.

Members present:

Chairman, Richard I. Washburn; Howard Trip representing Robert E. Stevenson, Calgary, Alberta; Tom Silver representing Jim Kinghorn, Victoria, B.C.; Don Lucht representing Frank Yasinski, Albuquerque, N.M.; Galen Trostle, Secretary-Treasurer; Paul Grossenbach, Local Arrangements; Bill Klein, Program Chairman.

It was moved by Howard Trip and Paul Grossenbach that the registration fee be established at $5.00 for the 1967 Conference and so ordered.

It was moved by Don Lucht and Howard Trip that the Treasurer's report be accepted and be reported to the Conference and so ordered.

A discussion followed covering the following points:

1. That no further action be taken by the Western Forest Insect Conference to meet jointly with the Western Forest Disease Conference until such a time that it becomes evident that such a meeting is needed and can be conveniently arranged.

2. That the Conference consider the proposal that the responsibility of the Secretary-Treasurer be extended to include the preparation of the Proceedings for the Conference during which his term is terminated.

3. Letters sent to Mexican Entomologist.

4. A proposal by one of its members to hold this Conference every year. Your Executive Committee agreed to recommend that the annual meeting be continued.

   G. Silver and Howard Trip moved that the meeting be adjourned. The Chairman so ordered its adjournment at 10:00 p.m.

APPENDIX

Annual Report For 1966-1967

COMMITTEE ON COMMON NAMES OF WESTERN FOREST INSECTS

Western Forest Insect Work Conference

Committee Membership

As stated in the report of the annual meeting, February 14, 1966, Mr. Philip C. Johnson, after several years completed his tenure as a Committee member and as Chairman of the Committee. His organizational work had been greatly responsible for the success of the group.

Malcolm M. Furniss and John A. Schenk, both of Moscow, Idaho, were appointed by the Conference Executive Committee on February 13, 1966, to replace Philip C. Johnson and George R. Struble.

David Evans was elected as Chairman of the Committee for a one-year period, or to the duration of the 1967 Conference.

Common Names

The one outstanding proposal, from Mr. Boyd E. Wickman, for the name Incense-cedar wood wasp for *Syntexis libocedrii*, was accepted by the E. S. A. Committee on Common Names (December 14, 1966).

Only one new proposal for a common name was received, and is currently under consideration by our Committee.

Respectfully submitted
Committee on Common Names of
Western Forest Insects

David Evans, Victoria Chm. (1967)
Malcolm M. Furniss, Moscow (1971)
Donald A. Pierce, Albuquerque (1969)
John A. Schenk, Moscow (1971)
Donald C. Schmiege, Juneau (1969)
Robert E. Stevenson, Calgary (1970)
David L. Wood, Berkeley (1968)

Victoria, B.C.
February 22, 1967

REPORT OF ANNUAL MEETING

Committee on Common Names of Western Forest Insects

Western Forest Insect Work Conference

Las Vegas, Nevada

February 28, 1967

The meeting was called to order at 8:00 p.m. at the Stardust Hotel by Committee Chairman, David Evans. Committee members present were Donald D. Lucht (for D. A. Pierce), John A. Schenk, Donald A. Schmiege, Howard A. Tripp (for R. E. Stevenson), David L. Wood, and member-elect Les H. McMullen.

Dr. McMullen, Section Head of Forest Entomology at the Forest Research Laboratory, Victoria, B.C., had been appointed earlier by the Conference Executive Committee to replace outgoing member David Evans. He is also a Common Names Committee member of the Canadian Entomology Section.

The common name of spruce mealybug for Puto sandini was discussed, and accepted with reservation, pending certain clarification from the applicant, and the additional vote of one absent committee member.

Our new Committee Chairman, Robert E. Stevenson, Entomology Research Officer at the Canada Forest Research Laboratory, Calgary, Alberta, was elected unanimously to serve for the next four years. He has accepted the position.

The meeting adjourned at 8:35 p.m.

Respectfully submitted
Committee on Common Names of
Western Forest Insects

David Evans (1967) Chairman
David L. Wood (1968)
Donald A. Pierce (1969)
Donald C. Schmiege (1969)
Robert E. Stevenson (1970)
Malcolm M. Furniss (1971)
John A. Schenk (1971)

TREASURER'S REPORT

as of

February 20, 1967

Balance on Hand February 9, 1966		$ 414.17
Expenses for 1966 Meeting		777.01
Received from Registration		749.12
Balance on Hand April 1, 1966		
(Canadian Funds)	$ 386.28	
(American Funds)	357.25	
Expenses for preparation of proceedings	12.80	
Balance on Hand	$ 344.45	

MEMBERSHIP ROSTER

WESTERN FOREST INSECT WORK CONFERENCE

Note: Active members registered at the Conference in Las Vegas, Nevada, February 28 - March 3, 1967, are indicated by an asterisk.

A. WESTERN MEMBERS

ALLEN, DR. GEORGE A.
(Director)
Weyerhaeuser Research Center
Weyerhaeuser Company
Tacoma, Washington 98401

AMEN, CLARK R.
American Cyanamid Co.
1445-14th Place
Corvallis, Oregon 97330

ASHRAF, MUHAMMAD
Department of Entomology
Washington State University
Pullman, Washington 99163

*ATKINS, DR. M.D.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

BAILEY, WILMER F.
(Forester)
U. S. Forest Service
13429 W. 23rd Place
Golden, Colorado 80401

BAKER, BRUCE H.
(Entomologist)
U. S. Forest Service
Box 1631
Juneau, Alaska 99801

BALDWIN, PAUL H. (DR.)
(Zoology Professor)
Colorado State University
Fort Collins, Colorado 80521

BARR, DR. W.F.
(Professor)
University of Idaho
Moscow, Idaho 83843

BEDARD, DR. W. D.
(Entomologist)
Pacific Southwest Forest and Range Experiment Station
P. O. Box 245
Berkeley, California 94701

BELLUSCHI, PETER
Weyerhaeuser Research Center
Weyerhaeuser Company
Tacoma, Washington 98401

BERRYMAN, DR. ALAN A.
(Assistant Professor)
Department of Entomology
Washington State University
Pullman, Washington 99163

BILLINGS, RONALD F.
Entomology Department
Oregon State University
Corvallis, Oregon 97331

BLOMSTROM, ROY N.
(Forester)
U. S. Forest Service R-5
7847 Eureka
El Cerrito, California 94530

BORDEN, TOM B.
(State Forester)
Colorado State Forest Service
Colorado State University
Fort Collins, Colorado 80521

BORG, THOMAS K.
(Student)
121 E. Lake
Fort Collins, Colorado 80521

BRIGHT, DONALD E., JR.
(Student)
University of California, Berkeley
259 Wilson Street
Albany, California 94706

BRIX, DR. HOLGER
(Plant Physiologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B.C.

*BROWN, C.E.
(Entomologist)
Department of Forestry
102-11th Avenue East
Calgary, Alberta

*BROWNE, LOYD, E.
Department of Entomology and
Parasitology
Agriculture Hall
University of California
Berkeley, California 94701

BUFFAM, P.E.
(Entomologist)
U. S. Forest Service
517 Gold Avenue S.W.
Albuquerque, New Mexico 87101

*CAHILL, DONALD B.
(Entomologist)
U. S. Forest Service
Missoula Equipment Development
Center
Missoula, Montana 59801

CAROLIN, V. M. JR.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

CARPENTER, G. P.
(Research Representative)
Geigy Ag. Chem.
916 Deborah Dr.
Loveland, Colorado 80537

CARROW, ROD
(Student)
6101 N.W. Marine Drive
Vancouver, B.C.

CAYLOR, JULE
1733 Ward Street
Berkeley, California 94704

*CEREZKE, DR. HERBERT F.
(Entomologist)
Department of Forestry
102-11th Avenue, East
Calgary, Alberta

CHAMBERLIN, DR. W. J.
3320 Chintimini Avenue
Corvallis, Oregon 97330

CHANSLER, JOHN F.
(Entomologist)
U. S. Forest Service
Denver Federal Center
Building 85
Denver, Colorado 80225

CHAPMAN, DR. JOHN A.
(Entomologist)
Department of Forestry
506 W. Burnside Road
Victoria, B. C.

COLE, WALTER E.
(Entomologist)
900 Athens Drive
Apartment C
Raleigh, N. C. 27606

*CONDRASHOFF, SERGEI F.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*CORNELIUS, ROYCE O.
(Managing Forester)
Weyerhaeuser Company
Tacoma Building
Tacoma, Washington 98401

COULTER, WILLIAM K.
(Entomologist)
Pacific Northwest Forest &
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*COX, ROYCE G.
(Forester)
Potlatch Forests Inc.
Lewiston, Idaho 83501

*CROSBY, DAVID
(Entomologist)
U. S. Forest Service
Box 1631
Juneau, Alaska 99801

*DAHLSTEN, DR. D. L.
(Entomologist)
Div. of Biological Control
University of California
1050 San Pablo Avenue
Albany, California 94706

DAVIS, DR. DONALD A.
(Associate Professor)
Department of Zoology and
Entomology
Utah State University
Logan, Utah 84321

*DeMARS, C. J.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*DENTON, ROBERT E.
(Entomologist)
Intermountain Forest and
Range Experiment Station
Forestry Service Lab.
Box 468
Moscow, Idaho 83843

DOLPH, ROBERT E., JR.
(Entomologist)
U. S. Forest Service
P. O. Box 32623
Portland, Oregon 97208

DOTTA, DANIEL D.
(Forester)
California Div. of Forestry
Resources Building
1416 Ninth Street
Sacramento, California 95814

*DOWNING, GEORGE L.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*DYER, E. D. A.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

EBELL, DR. LORNE F.
(Plant Physiologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

EDWARDS, DR. D. K.
(Entomologist)
Forest Research Laboratory
Department of Forestry
506 W. Burnside Road
Victoria, B. C.

*ELA, TOM F.
National Park Service
P. O. Box 728
Sante Fe, New Mexico 87501

*EVANS, D.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

FARRIS, S. H.
Department of Forestry
506 W. Burnside Road
Victoria, B. C.

FELLIN, DAVID G.
(Entomologist)
Intermountain Forest and
Range Experiment Station
Forest Service Building
Missoula, Montana 59801

FERGUSON, W. E.
(Associate Professor)
San Jose State College
San Jose, California 95114

FISHER, ROBERT A.
(Product Manager)
Bioferm Div. I.M.C.
Bin B.
Wasco, California 93280

*FLAKE, HAROLD W., JR.
(Entomologist)
U. S. Forest Service
Federal Office Building
324 - 25th Street
Ogden, Utah 84401

FLESCHNER, DR. C. A.
Department of Biological Control
University of California
Riverside, California 92507

*FURNISS, MALCOLM M.
(Entomologist)
Intermountain Forest and
Range Experiment Station
Forestry Sciences Laboratory
P. O. Box 469
Moscow, Idaho 83843

FURNISS, R. L.
(Consulting Forest Entomologist)
6750 SW 35th Avenue
Portland, Oregon 97219

GERMAIN, CHARLES J.
221 Forestry Building
Colorado State University
Fort Collins, Colorado 80521

GOYER, RICHARD A.
College of Forestry
University of Idaho
Moscow, Idaho 83843

*GRAHAM, DR. KENNETH
(Prof. of Forest Entomology)
Department of Zoology
Biological Sciences Building
University of British Columbia
Vancouver 8, B. C.

GRAMBO, ERNEST J.
(Assistant Regional Forester)
U. S. Forest Service
Denver Federal Center
Denver, Colorado 80225

GUY, W. C.
(Photographer)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*GUSTAFSON, ROBERT W.
U. S. Forest Service
630 Sansome Street
San Francisco, California 94111

HALL, DR. RALPH C.
(Consulting Forest Entomologist)
72 Davis Road
Orinda, California 94563

HALLING, C. S.
Department of Forestry
506 W. Burnside Road
Victoria, B. C.

*HAGLAND, HERBERT
U. S. Bureau of Land Management
P. O. Box 3861
Portland, Oregon 97208

HARD, JOHN S.
U. S. Forest Service
Box 1631
Juneau, Alaska 99801

*HARRIS, DR. JOHN W. E.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

HEDLIN, A. F.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*HEIKKENEN, DR. HERMAN J.
(Professor of Forest Entomology)
University of Washington
Seattle, Washington 98105

*HELLER, ROBERT C.
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*HESTER, D. A.
(Forester)
U. S. Forest Service
Denver Federal Center, Bldg. 85
Denver, Colorado 80225

HOCKING, DR. BRIAN
(Head)
Department of Entomology
University of Alberta
Edmonton, Alberta

HOFFMAN, DONALD M.
(Associate Wildlife Biologist)
Dept. of Game, Fish and Parks
Box 307
LaVita, Colorado 81055

HONING, FRED W.
(Entomologist)
U. S. Forest Service
Federal Building
Missoula, Montana 59801

HOPPING, GEORGE R.
9924 - 5th Street SE
Calgary, Alberta

HOUSE, GORDON M.
Department of Entomology
Oregon State University
Corvallis, Oregon 97331

HOWARD, BENTON
(Forester)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

JAENICKY, A. J.
2941 Mulkey Street
Corvallis, Oregon 97330

*JOHNSEY, RICHARD L.
Washington State Dept. of
Natural Resources
Route 4, Box 424B
Olympia, Washington 98501

*JOHNSON, DR. N. E.
(Entomologist)
Weyerhaeuser Research Center
P. O. Box 420
Centralia, Washington 98531

JOHNSON, PHILIP C.
(Entomologist)
Intermountain Forest and
Range Experiment Station
Federal Building
Missoula, Montana 59801

KEEN, F. P.
1054 Oak Hill Road
Lafayette, California 94549

KIMMINS, J. P.
1734 Delaware Street
Berkeley, California 94703

KINGHORN, J. M.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*KINN, DONALD N.
(Student)
University of California
Department of Entomology
1038 9th Street
Albany, California 97710

KINZER, HENRY G.
(Entomologist)
New Mexico State University
University Park
New Mexico 88070

*KLEIN, BILL
(Entomologist)
U. S. Forest Service
324 - 25th Street
Ogden, Utah 84401

*KLINE, LeROY N.
(Forester)
Oregon State Dept. of Forestry
P. O. Box 2289
Salem, Oregon 97310

*KNOPF, JERRY A. E.
(Entomologist)
U. S. Forest Service
3320 Americana Terrace
Boise, Idaho 83706

KNOWLTON, DR. GEORGE F.
(Professor of Entomology)
Utah State University
Logan, Utah 84321

KOERBER, T. W.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

KOPLIN, JAMES R.
(Student)
Colorado State University
709 S. Washington
Fort Collins, Colorado 80521

*LANIER, GERRY
(Student)
Department of Entomology and
Parasitology
University of California
Berkeley, California 94704

LARA, ING. RAUL RODRIQUEZ
Seccion Entomologia
Instituto Nacional de
Investigacionea Forestales
Progresso No. 5
Coyaocan, D. F., Mexico

*LARSEN, ALBERT T.
(Director)
Insect and Disease Control
State Dept. of Forestry
P. O. Box 2289
Salem, Oregon 97310

LAUCK, DR. DAVID R.
(Associate Professor)
Humboldt State College
Arcata, California 95521

LAUTERBACK, PAUL G.
(Research Forester)
Weyerhaeuser Research Center
Weyerhaeuser Company
Tacoma, Washington 98401

LEJEUNE, R. R.
(Regional Director)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*LEMBRIGHT, HAROLD W.
(Agriculturist)
Dow Chemical Co.
350 Sansome Street
San Francisco, California 94106

*LISTER, C. KENDALL
U. S. Forest Service
Federal Office Building
324 - 25th Street
Ogden, Utah 84401

*LOWE, JAMES H. JR.
School of Forestry
University of Montana
Missoula, Montana 59801

LOWRY, DR. W. P.
Department of Statistics
School of Science
Oregon State University
Corvallis, Oregon 97331

*LUCHT, DONALD
Federal Building
517 Gold Avenue, SW
Albuquerque, New Mexico 87101

LUCK, ROBERT F.
Dept. of Entomology and
Parasitology
University of California
Berkeley, California 94704

LYON, DR. R. L.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*MAHONEY, JOHN
(Chief Forester)
National Park Service, R-4
180 New Montgomery Street
San Francisco, California 94105

MAKSYMIUK, BOHDAN
Pacific Northwest Forest and
Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

MANIS, DR. H. C.
(Head)
Department of Entomology
University of Idaho
Moscow, Idaho 83843

MARSHALL, KNOX
Western Pine Association
1100 Tenth Avenue
Sacramento, California 95818

MASON, RICHARD R.
Forest Science Laboratory
3200 Jefferson Way
Corvallis, Oregon 97331

MASSEY, DR. CALVIN L.
(Entomologist)
Rocky Mountain Forest and
Range Experiment Station
5423 Federal Building
517 Gold Avenue SW
Albuquerque, New Mexico 87101

MATHERS, W.G.
(Administrative Officer)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

*McCAMBRIDGE, W. F.
(Entomologist)
Rocky Mountain Forest and
Range Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

*McCOMB, DAVID
(Entomologist)
U. S. Forest Service
P. O. Box 3141
Portland, Oregon 97208

McGREGOR, M. D.
(Entomologist)
U. S. Forest Service
Forest Service Building
324 - 25th Street
Ogden, Utah 84401

McKINNON, F. S.
(Chief Forester)
B. C. Forest Service
Parliament Buildings
Victoria, B. C.

McKNIGHT, MELVIN E.
(Entomologist)
Rocky Mountain Forest and Range
Experiment Station
Colorado State University
Fort Collins, Colorado 80521

*McMULLEN, DR. L. H.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

MESO, STANLEY W., JR.
(Forester)
U. S. Forest Service
Pacific Northwest Region
P. O. Box 3623
Portland, Oregon 97208

*MITCHELL, DR. RULLEL G.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

MOGREN, DR. E. W.
(Associate Professor)
College of Forestry and
Range Management
Colorado State University
Fort Collins, Colorado 80521

MOLNAR, ALEX C.
Department of Forestry
506 W. Burnside Road
Victoria, B. C.

*MOORE, DR. A. D.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

MORRIS, DR. O. N.
(Insect Pathologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

NAGEL, DR. W. P.
(Associate Professor)
Department of Entomology
Oregon State University
Corvallis, Oregon 97331

NORIEGA, ING. HUMBERTO MORENO
Jefe del Dpto. de Sanidad
Forestal
Direccion de Proteccion
Forestal
Aquiles Serdan 28
Tercer Piso
Mexico 4, D. F.

ORR, P. W.
(Entomologist)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

*OTVAS, IMRE
(Student)
Department of Entomology and
Parasitology
University of California
Berkeley, California 94704

PEARSON, ERNEST
(Forester)
State Department of Forestry
P. O. Box 2289
Salem, Oregon 97310

PETTINGER, LEON F.
(Entomologist)
U. S. Forest Service
P. O. Box 3623
Portland, Oregon 97208

PIERCE, D. A.
(Entomologist)
U. S. Forest Service
Federal Building
517 Gold Avenue, S. W.
Albuquerque, New Mexico 87101

*PIERCE, J. R.
(Entomologist)
U. S. Forest Service
630 Sansome Street
San Francisco, California
94111

*PILLMORE, RICHARD E.
(Research Biologist)
Bureau of Sport Fisheries
and Wildlife
Denver Federal Center, Bldg. 45
Denver, Colorado 80225

*PITMAN, GARY B.
(Entomologist)
Boyce Thompson Institute
P. O. Box 1119
Grass Valley, California 95945

POWELL, JOHN M.
Canada Department of Forestry
102-11th Avenue, E
Calgary, Alberta

REID, ROBERT WILLIAM
(Entomologist)
Department of Forestry
102 - 11th Avenue E.
Calgary, Alberta

*RICE, RICHARD
Department of Entomology
University of California
633 T. Street
Davis, California 95616

RICHMOND, H. A.
(Consulting Forest Entomologist)
Lofthouse Road
R. R. #2
Nanaimo, B. C.

RITCHER, DR. PAUL O.
(Head)
Department of Entomology
Oregon State University
Corvallis, Oregon 97331

ROBINS, JACK
(Ranger Supervisor)
Department of Forestry
Forest Research Laboratory
102 - 11th Avenue E.
Calgary, Alberta

ROETTGERING, BRUCE
(Entomologist)
U. S. Forest Service
Box 1631
Juneau, Alaska 99801

ROSE, W. E.
(Entomologist)
Northern Forest Experiment
Station
Box 740
Juneau, Alaska 99801

ROSS, DR. D. A.
(Officer-in-Charge)
Forest Entomology Laboratory
Department of Forestry
Box 1030
Vernon, B. C.

RUBIO, SENOR FRANCISCO FERNANDEZ
Montrose Mexicana, S. A.
Ave. Madero No. 2-4, Piso
Postal 2124
Mexico 1, D. F.

RUDINSKY, DR. JULIUS A.
(Professor)
Department of Entomology
Oregon State University
Corvallis, Oregon 97331

*RYAN, DR. ROGER
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

SAFRANYIK, LES
Department of Forestry
102 - 11th Avenue E.
Calgary, Alberta

SARTWELL, CHARLES, JR.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

*SCHAEFER, DR. C. H.
Shell Development Co.
P. O. Box 3011
Modesto, California 95353

*SCHENK, DR. JOHN A.
(Associate Professor)
University of Idaho
Moscow, Idaho 83843

*SCHMID, JOHN M.
Rocky Mountain Forest and
Range Experiment Station
Fort Collins, Colorado 80521

SCHMIDT, FRED H.
(Entomologist)
Pacific Northwest Forest and
Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

*SCHMIEGE, DR. DONALD E.
(Entomologist) Visiting Prof.
Northern Forest Experiment
Station
Box 740
Juneau, Alaska 99801

SCHMITZ, RICHARD F.
(Entomologist)
Intermountain Forest and
Range Experiment Station
Forest Service Building
Missoula, Montana 59801

SCHMUNK, OSCAR H.
(Assistant State Forester)
Colorado State Forest Service
Colorado State University
Fort Collins, Colorado 80521

SHEN, SAMUEL K.
Department of Entomology
Washington State University
Pullman, Washington 99163

*SHEA, KEVIN
1369 Carlos Avenue
Richmond, California 94802

SHEPHERD, DR. ROY F.
(Entomologist)
Department of Forestry
Forest Research Laboratory
102 - 11th Avenue, East
Calgary, Alberta

*SILVER, DR. G. T.
Associate Regional Director
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

SMITH, D. N.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

SMITH, DR. RICHARD H.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

SPILSBURY, R. H.
(Forester-in-Charge)
Research Division
B. C. Forest Service
Victoria, B. C.

*STARK, DR. R. W.
(Associate Professor)
Department of Entomology and
Parasitology
University of California
Berkeley, California 94720

STELZER, MILTON J.
(Entomologist)
Rocky Mountain Forest and
Range Experiment Station
5423 Federal Building
517 Gold Avenue, SW
Albuquerque, New Mexico 87101

STEVENS, DR. ROBERT E.
Div. of Forest Protection Research
USDA, South Building
12th & Independence Avenue SW
Washington, D. C. 20250

STEVENSON, R. E.
(Entomologist)
Forest Research Laboratory
Department of Forestry
102 - 11th Avenue, East
Calgary, Alberta

STEWART, JAMES L.
U. S. Forest Service
Denver Federal Center
Denver, Colorado 80225

STRUBLE, G. R.
(Entomologist)
Pacific Southwest Forest and Range Experiment Station
P. O. Box 245
Berkeley, California 94701

STURGEON, DR. E. E.
Division of Natural Resources
Humboldt State College
Arcata, California 95521

*SWAIN, K. M.
(Entomologist)
c/o San Bernardino National Forest.
P. O. Box 112
San Bernardino, California 92401

TELFORD, DR. HORACE S.
(Chairman)
Department of Entomology
Washington State University
Pullman, Washington 99163

THATCHER, DR. T. O.
(Professor)
Department of Entomology
Colorado State University
Fort Collins, Colorado 80521

TAYLOR, KARL B.
1706½ Opal St.
Pullman, Washington 99163

THOMAS, DR. G. P.
(Regional Director)
Forest Research Laboratory
Department of Forestry
102 - 11th Avenue, East
Calgary, Alberta

*THOMPSON, DR. C. G.
(Entomologist)
Pacific Northwest Forest and Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

THOMPSON, HUGH E.
Department of Entomology
Kansas State University
Manhattan, Kansas 66502

*TORGERSEN, TOROLF R.
Institute of Northern Forestry
Box 909
Juneau, Alaska 99801

*TRIPP, HOWARD A.
Canada Department of Forestry
102 - 11th Avenue, East
Calgary, Alberta

*TROSTLE, GALEN C.
(Entomologist)
U. S. Forest Service
Federal Office Building
324 - 25th Street
Ogden, Utah 84401

*TUNNOCK, SCOTT
(Entomologist)
U. S. Forest Service
Federal Building
Missoula, Montana 59801

TURNER, J. A.
Canada Department of Forestry
506 W. Burnside Road
Victoria, B. C.

*VALCARCE, ARLAND
U. S. Forest Service
St. Anthony, Idaho 83445

*VITE, PETER
P. O. Box 119
Grass Valley, California

WALKER, CLYDE M.
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

*WASHBURN, RICHARD I.
(Entomologist)
U. S. Forest Service
Forest Sciences Lab.
Box 469
Moscow, Idaho 83843

*WEAR, J. F.
(Research Forester)
Pacific Northwest Forest and
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

WELLINGTON, DR. W. G.
(Entomologist)
Department of Forestry
Forest Research Laboratory
506 W. Burnside Road
Victoria, B. C.

WERNER, DR. F. C.
Dept. of Entomology
University of Arizona
Tucson, Arizona 85721

WERNER, DR. RICHARD A.
(Entomologist)
Forestry Science Laboratory
Southeastern Forest Experiment
Station
P. O. Box 12254
Research Triangle Park,
North Carolina 27709

*WERT, STEVEN
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

WICKMAN, BOYD E.
(Entomologist)
Pacific Southwest Forest and
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

WILFORD, DR. B. H.
(Entomologist) (Retired)
Route 3, Box 524
Fort Collins, Colorado 80521

WILLIAMS, DR. CARROLL B., JR.
(Research Forester)
Pacific Southwest Forest &
Range Experiment Station
P. O. Box 245
Berkeley, California 94701

WITTIG, DR. GERTRAUDE C.
(Microbiologist)
Pacific Northwest Forest and
Range Experiment Station
3200 Jefferson Way
Corvallis, Oregon 97331

*WOOD, DR. D. L.
(Entomologist)
Department of Entomology &
Parasitology
University of California
Berkeley, California 94720

WRIGHT, KENNETH H.
(Entomologist)
Pacific Northwest Forest &
Range Experiment Station
P. O. Box 3141
Portland, Oregon 97208

WYGANT, DR. NOEL D.
(Chief)
Div. of Forest Insect Research
Rocky Mtn. Forest & Range
Experiment Station
Colorado State University
221 Forestry Building
Fort Collins, Colorado 80521

YASINSKI, F.M.
(Entomologist)
U. S. Forest Service
Federal Building
517 Gold Avenue, SW
Albuquerque, New Mexico 87101

ZINGY, JOHN G.
1332 Harrison Avenue
Centralia, Washington 98531