26TH
SOUTHERN
FOREST
INSECT
WORK
CONFERENCE

GAINESVILLE, FLORIDA
AUGUST 10-13, 1981
COVER: Drawn by Dr. Wayne N. Dixon, Florida Department of Agriculture and Consumer Services, Division of Forestry, Gainesville, Florida.

The cover exemplifies the theme of the 26th SFIWC--"Technology for Management of Southern Forest Insects." As explained by Dr. Dixon, "the computer is to signify our new directions. The lighted ball conceptualizes the shedding of light on management choices or decisions. And yet, the hand shows that people are always the utter backbone of technological innovations."
MINUTES

TWENTY-SIXTH ANNUAL
SOUTHERN FOREST INSECT WORK CONFERENCE

Gainesville, Florida
August 10-13, 1981
James A. Richmond, Program Chairman

Unedited


Chairman------------------------ R. L. Hedden
Secretary-Treasurer------------- G. N. Mason
Counselors-------------------- C. W. Berisford
                                   J. F. Godbee
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Minutes--Preliminary Business Meeting

Minutes--Final Business Meeting

Treasureer's Report

Historian's Report

Membership
Program
26th Southern Forest Insect Work Conference
August 10-13, 1981
Gainesville, Florida

Monday, August 10
1:30-4:30 p.m.  Regional Seed and Cone Project S-118
Chairman: Gary L. DeBarr, USDA Forest Service, Athens, GA

6:00-7:00 p.m.  Pre-Executive Committee Meeting

6:00-9:00 p.m.  Registration

7:30-9:00 p.m.  Bark Beetle Project S99
Chairman: C. Wayne Berisford, University of Georgia, Athens, GA

Tuesday, August 11
8:00-9:00 a.m.  Registration

9:00-9:15 a.m.  Opening Remarks--Roy L. Hedden, Chairman,
26th Annual SFIWC, Clemson University, SC
Welcome--John L. Foltz, University of Florida, Gainesville, FL

9:15-9:45 a.m.  Keynote Address-Helen Bhattacharyya, Mathematical
Statistician, USDA Forest Service, Research Triangle Park, NC.

9:45-10:00 a.m.  Break

10:00-10:30 a.m.  Outstanding Contribution Award--Chairman:
Stephen C. Cade, Weyerhaeuser Co., Hot Springs, AR

10:30-11:30 a.m.  Open Business Meeting

11:30-1:00 p.m.  Lunch

Intercurrent Workshops

1:00-3:00 p.m.  Workshop 1: Presented Papers - Richard A. Goyer,
Louisiana State University, Baton Rouge, LA

2:00-4:00 p.m.  Workshop 2: Disease/Insect/Tree Interactions -
John R. Bridges, USDA Forest Service, Pineville, LA, Thomas Miller, USDA Forest Service, Okeechobee, FL
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<td>Workshop 3: Silviculture Practices and Forest management - Fred P. Hain, N. C. State University, Raleigh, NC, Roger P. Belanger, USDA Forest Service, Athens, GA</td>
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<td>7:00-8:00 p.m.</td>
<td>Workshop 8: Aerial Survey and Remote Sensing - William H. Clerke, USDA Forest Service, Atlanta, GA, Bill Carothers, USDA Forest Service, Doraville, GA</td>
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<td>Photo Salon - Larry Barber, USDA Forest Service, Asheville, NC</td>
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<td>Workshop 4: Behavioral Chemicals to Manipulate Forest Insect Populations - Ron F. Billings, Texas Forest Service, Lufkin, TX, Carl W. Fatzinger, USDA Forest Service, Olustee, FL</td>
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<td>Workshop 5: Ways to Overcome Barriers to Forest Insect Research - W. W. Neel, Mississippi State University, Mississippi State, MS</td>
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<td>10:00-12:00 noon</td>
<td>Workshop 6: Pesticides: Environmental Considerations and Use - Felton L. Hastings, USDA Forest Service, Research Triangle Park, NC, John W. Taylor, USDA Forest Service, Atlanta, GA</td>
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<td>1:00-3:00 p.m.</td>
<td>Workshop 7: Enhancement of Natural Enemies - Vicki H. Fedde, USDA Forest Service, Athens, GA, Timothy Tigner, Virginia Division of Forestry, Charlotteville, VA</td>
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Thursday, August 13

Intercurrent Workshops

8:00-10:00 a.m.
Workshop 10: Impact and Control of Seed and Cone Insects - R. Scott Cameron, Texas Forest Service, Lufkin, TX, Terry S. Price, Georgia Forestry Commission, Macon, GA

9:00-11:00 a.m.
Workshop 11: Model Concepts and their Utility - Fred M. Stephen, University of Arkansas, Fayetteville, AR, Carroll B. Williams, Jr., USDA Forest Service, Berkeley, CA
1981

OUTSTANDING CONTRIBUTION AWARDS

L. H. Kudon and C. W. Berisford for their publication--"Influence of brood hosts on host preferences of bark beetle parasites." Nature 283(5744):288-290

KEYNOTE ADDRESS
SOUTHERN FOREST INSECT WORK CONFERENCE

Helen Bhattacharyya
Mathematical Statistician
USDA Forest Service
Research Triangle Park, NC

When I was first approached about making the keynote address at the 26th Southern Forest Insect Work Conference, my initial reaction was one of incomprehension. It is an awesome honor to be speaking to a group of learned entomologists when I am still struggling with the difference between worms and bugs and insects. The only bugs that I am familiar with are those that infest computer programs—and they are hard to get rid of!

More seriously, I believe you do honor, not so much to me, as to the profession of statisticians in having me here today. There is a history of good vibrations between statistics and the biological sciences. Many of you here have taken courses in statistics and probably remember the name R. A. Fisher, the grand old man of modern statistics and of Fisher and Yates' tables, which every student ultimately consults to determine whether the number so painstakingly computed should receive one star, two stars, or no stars. Both Fisher and Yates are rooted in the biological sciences, having done their most productive work at the celebrated Rothamsted Experimental Station in England. Fisher died in 1962. Frank Yates is still at Rothamsted and recently wrote a series of letters appearing in the British journal Nature concerning the statistical methods used in a government report on the effect of gassing of badgers on breakdown of cattle herd due to tuberculosis in South Wales. Apparently there is some dispute as to whether the decline, if there is a decline, in herd breakdown is due to badger gassing or just a general decline in all regions. The badger controversy, as far as I know, is still raging in the pages of Nature among Dr. Yates, Lord Zukerman of the report, and the Honorable Dr. Flowerdew of the Mammal Society. As you see, results of statistical studies are not always conclusive.

Another noted statistician, Chester Bliss, who was a cofounder of the Biometrics Society, publishers of the prestigious journal Biometrics, had even closer ties with entomologists. He received his B.A. from Ohio State in 1921 in entomology and did his Ph.D. in zoology at Columbia University under T. H. Morgan, the Nobel Laureate, working on the fruit fly, Drosophila melanogaster. In the 1930's, Bliss also found his way to Rothamsted Experimental Station and did much of the early work on bioassay and probit analysis, a procedure with which I know some of you are intimately acquainted.

Of course, not all statisticians are entomologists or vice versa. During my years with the Forest Service, I have had the privilege of working with a number of entomologists. I have been impressed by the level of statistical sophistication in many of our scientists, and I have been even more impressed by the free and open manner in which professional statistical expertise is sought where needed.
Statistics, I believe, is a symbiotic science. As the scientific method dictates that valid conclusions be based on proper data gathering and proper statistical interpretation, so statistics then must find its raison d'etre in being able to deal with other people's problems. Our professional satisfaction comes from participation in the studies of others. It is our business to help design experiments, to help define and formalize the problem, and to help extract maximum information from the data collected.

As an early example of cooperation between scientist and statistician, I would like to read you an excerpt of a communication between Charles Darwin and Sir Francis Galton, a noted statistician. This is given in Darwin's book on "The Effect of Cross and Self-Fertilization in the Vegetable Kingdom," dated 1876.

"I long doubted whether it was worthwhile to give the measurements of each separate plant, but have decided to do so, in order that it may be seen that the superiority of the crossed plants over the self-fertilised does not depend on the presence of two or three extra fine plants on the one side, or a few very poor plants on the other side .... As only a moderate number of crossed and self-fertilised plants were measured, it was of great importance to me to learn how far the averages were trustworthy. I therefore asked Mr. Galton, who has had much experience in statistical researches, to examine some of my tables of measurements. I may premise that if we took by chance a dozen or score of men belonging to two nations and measured them, it would, I presume, be very rash to form any judgment from such small numbers on their average heights. But the case is somewhat different with my crossed and self-fertilised plants, as they were of exactly the same age, were subjected from first to last to the same conditions and were descended from the same parents ......"

By today's standards, the statistical methodology at the time was rather crude. Darwin, however, intuitively understood the fundamentals of good design, of the importance of replication, the difficulty with sampling error, and the necessity of strict control. His problem was how to arrive at a valid conclusion based on the results observed. That is, in today's parlance, whether the difference between means can be considered statistically significant. I should point out that this was 30 years before the formal discipline of statistics, before the t-test and F-test.

Statistically, we have come a long way since the time of Galton. We now have a formalized array of standard statistical procedures. We are all familiar with the many splendors of analysis of variance, with its ability to handle completely random designs; factorial designs; and blocked designs, complete and incomplete, balanced and unbalanced, split, nested, or confounded. Of course, in forest insect research, as in other fields of research, the basic principle is still to keep the layout simple. Good randomized block designs and factorial designs are still the bread and butter of designed experiments, as well as of most statistical analysts.
Besides analysis of variance, the other major area of classical statistics is regression analysis, which is often referred to today as linear models. Linear models offer a powerful unified framework for examining structural relationships among variables. In fact, though we seldom think of them in this way, all analyses of variance may be considered as special cases of linear models.

The simplest linear model is the simple regression model: \( Y = a + bX \), where \( Y \) is the dependent variable, \( X \) the independent variable, and \( a \) and \( b \) are the parameters of the model. More complicated linear models include multiple regression, analysis of variance, and analysis of covariance.

There is often confusion about what makes a model linear. In statistics, we define a linear model as one where the dependent variable is a linear function of the parameters. The simple regression model we just mentioned, \( Y = a + bX \), is linear because the dependent variable \( Y \) is a linear function of the parameters \( a \) and \( b \). In this case, it so happens that \( Y \) is also a linear function of \( X \), but that is immaterial. The model \( Y = a + bX + cX^2 \) is also linear because \( Y \) is a linear function of the parameters \( a \), \( b \), and \( c \); although clearly \( Y \) is not a linear function of \( X \). Similarly models such as \( Y = a + \log(X) \) or \( Y = a + bX \) are all linear.

The model \( Y = ax^b \), as given, is not linear, but it can be linearized by a logarithmic transformation: \( \log(y) = \log(a) + \log(X) \). Models that can be made linear by a transformation are also generally considered linear. An example of a nonlinear model might be \( Y = a + bX \).

For linear models, we now have standard procedures for estimating and testing regression coefficients, setting confidence intervals, and making predictions.

Although the development of statistical methodology has progressed steadily since the beginning of this century, the fortunes of applied statistics experienced a giant leap with the advent of computers. Many statistical methods that existed in theory only may now be carried out in practice. Stepwise regression and multiple regression involving many variables are now routinely performed. The use of nonlinear models has become widespread, and multivariate methods such as factor analysis, discriminant analysis, and multivariate analysis of variance are now within the realm of feasibility.

More than just being able to do calculations fast, the computer has also altered our approach to problem solving. Simulation studies allow us to have a glimpse of the solution without our having to know how to solve the problem mathematically. As an example, let us suppose there is a counter to which customers arrive and are being served. If the time between arrivals of successive customers is constant and the service time is also constant, say 4 minutes and 5 minutes, it is not difficult to compute the number of people in the queue at some time \( t \) in the future, assuming there is no one in the queue at time zero.
Now suppose we vary the conditions a little. Suppose the customers do not arrive at a constant rate, but at random rates according to some specified distribution. The problem of finding the queue length at time \( t \) is considerably more difficult, though still soluble. However, we can make the system increasingly more complicated. We can make the service time also random instead of constant. We can assume there are three counters and we can postulate rules about customer behavior, assuming, for example, that the customer will always join the shortest queue, may switch queues while waiting, and may go away if the waiting time becomes too long. Of course, here we shall have to define what "too long" means, whether it means the same thing to all customers or whether "too long" is also a random variable following a specified distribution.

Clearly the problem of determining queue lengths at time \( t \) can be made so complicated that a mathematical solution becomes impossible. For such situations, a simulation study can "easily" provide an accurate description of what can be expected at time \( t \).

To solve the three counter problems, we can simulate the process according to the rules specified and record the three queue lengths at time \( t \). Then we can simulate the process again, and again record the three queue lengths at time \( t \). The simulation procedure may be repeated, say 1,000 times. The 1,000 sets of queue lengths would then constitute an estimate of the theoretical distribution of queue lengths at time \( t \).

In simulations, the computer has made possible the use of highly complex models. Unfettered by the necessity of analytic tractability, the scientist is freed to explore models which may be more realistic, incorporating the full spectrum of information available.

It has often been pointed out to me that there is an air of magic about simulation studies, for they seemingly are able to give us results without any observed data. In the three-counter problem, we can obtain very accurate prediction of what would be the queue lengths after 2 hours, or 3 hours, or 5 years. The question is what does "accurate" mean. For the statistician or computer scientist engaged in simulation, accuracy means that had we been able to solve the system of equations theoretically, the solution would be very similar to the simulated solution. But for the scientist studying the three-counter problem, which may be considered a model of the checkout lines at the local grocery store or the ticket counters at Gainesville airport, accuracy would have to mean that the simulated result actually reflects the real-world situation.

Clearly this accuracy is much more difficult to attain. The investigator must make great effort to ensure that the assumptions are realistic, that the customers do arrive according to the distribution assumed, that serving time is as assumed, that customer behavior about cutting in line, switching lines, etc. is as assumed, and that all variables that could affect the queue lengths, variables such as time of day, weather conditions, and so on, have been accounted for. In order to make these assumptions realistically, we may be reminded that there is no substitute for good data.
Although the theory of evolution may be assailed by many factions in this country today, it is gratifying to know that the scientific method is alive and well, and prospering. Indeed some may say it is prospering too much. With evermore powerful computing capability, there is a feeling among some scientists that the delight in technology is making us lose sight of the problems to be solved--that limitless computing resources may be leading to mindless research.

Ultimately, a study is most profitable if the investigator has thought through the problem thoroughly, knows what relationship is being sought, and knows the kind of data that must be collected to prove or disprove the hypothesis, or are relevant to the system being studied.

Finally, a word on statistical summary of results. Since much of our research is directed toward applications decisions, we owe it to the people who use our results to present our findings clearly and to make our recommendations simple. We statisticians should probably be the first to admit that too often our jargon has turned our explanations into convoluted mumbo-jumbo. Although hundreds of pages of computer printouts may have to be examined during the analysis, we would do well to remember that the final statistical summary ought to be, in total, less bulky than the original data collected.

I have always been apprehensive about presenting papers before an august gathering such as we have here because of what may happen afterwards. However, I have been assured that following the keynote address there will be no question and answer period and that I was free to indulge in my own opinions and prejudices, which I have. Thank you.
In vitro Rearing of Dendroctonus frontalis Zimmermann and Ips grandicollis (Eichhoff) on Tissue-Cultured Loblolly Pine Callus

by

Paul B. Nappen

A symbiotic relationship has been observed between the southern pine beetle, Dendroctonus frontalis Zimmermann, and the mycangial fungi, Ceratocystis minor var. barrassii and an unknown basidiomycete. This study investigated the effects of the mycangial fungi on in vitro rearing of the southern pine beetle. General trends indicate that byproducts of the mycangial fungi are inhibitory to the southern pine beetle. Fungal extracts had no effect on the beetles; conversely, macerated beetles had no effect on the fungi.

Ips beetles reared in the system developed by Mott et al. (1978) exhibited poor survival. Fifty percent of the beetles tunneled into the agar and died; six percent developed into adults.

The Use of Pheromone Traps in the Timing of Insecticide Applications for the Nantucket Pine Tip Moth

by

P. M. Gargiullo et al.

The object of this study was to determine when in the life cycle the larvae are most susceptible to a single insecticide application, and then find a way to predict this period. Ten dimethoate treatments were applied during the larval period at 3 - 4 day intervals; with a different set of plots being treated on each spray date. Number of infested buds per tree were subsequently determined for each set of plots. For two generations on loblolly pine in the Georgia piedmont, a gradual trend in spray efficacy occurred along spray dates, indicating a single optimum date. This date corresponds to 70 - 80% cumulative egg hatch. It can be predicted by using first pheromone trap catch as a biofix and accumulating degree - days over 10.8°C (egg development threshold).
Hazard Rating for Bark Beetles in Recreation Areas in East Texas

by

R. A. Mask and D. L. Kulhavy
Stephen F. Austin State University, Nacogdoches, TX

ABSTRACT

Eighteen recreation areas (managed by the USDA Forest Service and the US Army Corps of Engineers) on East Texas' Sam Rayburn Reservoir, were monitored for Ips and Dendroctonus beetle activity. Stands were delineated and rated for susceptibility to Dendroctonus frontalis, using the Southern Pine Beetle Hazard Rating Guide for Texas (rating based on basal area, tree height, and landform data). No southern pine beetle activity was found, but sporadic incidence of Ips calligraphus and Dendroctonus terebrans was noted. A discriminant function equation (of variables collected on campsites from infested and uninfested loblolly, longleaf and shortleaf pines), is being developed for predicting Ips calligraphus and Dendroctonus terebrans incidence on individual trees.

Evidence of a Male-Released Aggregation Pheromone in the Deodar Weevil, Pissodes nemorensis

by

Mark S. Fontaine
Department of Entomology & Nematology
University of Florida, Gainesville

Response of the deodar weevil, Pissodes nemorensis Germar (Coleoptera: Curculionidae) to traps containing slash pine bolts and either males, females, males with females, or no adults was studied in northern Florida. In each of two studies, significantly more weevils were caught at traps containing males than at any other treatment.

Approximately equal numbers of male and female weevils responded to all treatments in both studies. All weevils which were attracted to males were dissected and found to be reproductively mature. It is not known if virgin females respond to the aggregation pheromone.

Traps were run from September, 1980 to April, 1981 at a slash pine plantation in Gilchrist County, Florida. There were two peaks of response to male-baited traps over the breeding season. A large peak was observed in November and a smaller peak was seen in February. The second peak was probably not due to a second generation, but to a resumption in activity after the cold months of December and January.
**Ips calligraphus** Development at Constant Temperatures

by

Robert A. Haack

*Ips calligraphus* (Germar) (Coleoptera: Scolytidae) was reared at 20°, 25°, and 30°C in 30-cm-long slash pine bolts and slabs having an inner bark thickness of greater than 2.5 mm thick and prepared according to Wilkinson (1979 SFIWC Proceedings pp. 46-47). Throughout the period of brood development, bolts were dissected to determine the life stages present and slabs were radiographed to study sequential development of entire broods. Based on the radiography studies, the following topics were discussed for *I. calligraphus* at each rearing temperature: sequential brood development by life stage, cumulative egg gallery length per female, cumulative oviposition per female, peak time of parent adult reemergence, and peak time of brood adult emergence. Brood development in bolts was similar to that in slabs with respect to life stages present, time of reemergence, and time of emergence.

Response of Redheaded Pine Sawfly Males to a Synthetic Pheromone in Florida

by

A. H. Chappelka and R. C. Wilkinson

**ABSTRACT**

Field tests using the sawfly pheromone [3,7-dimethyl-pentadecan-2-ol acetate with (-)- erythro configuration (1S, 3S)] were conducted near Gainesville, Florida, during 1978-81 to determine the attraction of Neodiprion lecontei males to baited traps with respect to time of year and time of day. Greatest numbers of males were caught during May, July, and September in traps placed within a pine stand from July 1978 to July 1979. Males were only caught between 1400-2000 hr on 10 dates in June and 10 dates in September-October 1980, and 10 dates in June 1981, with greatest catches from 1600-1800 hr. Catches in a synthetic-baited trap and in virgin female-baited traps were similar with respect to time of day.
Nantucket Pine Tip Moth Infestations Related to Site/Stand Conditions in Nacogdoches County, Texas, Plantations

by

M. N. White and D. L. Kulhavy
School of Forestry
Stephen F. Austin State University
Nacogdoches, Texas 75962

With the development of an accurate yet fast sequential sampling system and the timely publication of the Nacogdoches County Soil Survey, a study was conducted to relate site and stand conditions to the infestation of Nantucket Pine Tip Moth (Rhyacionia frustrana). The screening of several variables using discriminant analysis will be used to develop a hazard rating system. Variables used in the discriminant function can be obtained using a soil survey and planting records.
GEOGRAPHIC CORRELATION OF SOUTHERN PINE BEETLE OUTBREAKS WITH HIGH HAZARD LITTLELEAF AND ANNOSUS ROOT ROT SITES
by
Robert L. Anderson and William H. Hoffard

A mapping of historical southern pine beetle outbreaks between 1960 and 1980 shows a strong correlation between outbreak counties and high hazard littleleaf disease and annosus root rot sites. While not conclusive, these distributions support the findings of researchers who cite the relationship between these diseases and southern pine beetle. Their control should benefit a long-term beetle suppression program.

RELATION OF THE DEODAR WEEVIL TO THE PITCH CANKER DISEASE OF SLASH PINE
by
G. M. Blakeslee

A series of cooperative studies between personnel of the School of Forest Resources and Conservation and the Department of Entomology and Nematology at the University of Florida have shown that the deodar weevil Pissodes nemorensis, functions both as a vector of the pitch canker fungus, Fusarium moniliforme var. subglutinans, and as a wounding agent effective in creating infection courts suitable for the pathogen. The temporal and spatial aspects of the insect biology match the infection biology of the fungus on slash pine. The fungus is associated with the immature stages of the insect as well as with newly-emerging and actively feeding and/or reproducing adults. Fresh weevil feeding wounds on slash pine are frequently colonized by the fungus. When evaluated under greenhouse conditions, slash pines remained disease-free following feeding by pathogen-free weevils, however, artificial inoculation of such feeding wounds with the pathogen resulted in the development of characteristic symptoms of pitch canker. Artificial inoculation of weevil feeding wounds demonstrated that such wounds can serve as suitable infection courts for at least 48 hours after feeding has ceased. Transmission of the pathogen and subsequent disease development of the slash pine host has been demonstrated under both greenhouse and field conditions. The relative importance of this insect-disease relationship to the epidemiology of the disease requires further investigation.
INTERACTIONS BETWEEN SOUTHERN CONE RUST AND CONEWORMS IN SLASH PINE SEED ORCHARDS

by
C. W. Fatzinger and T. Miller

During 1980, a heavy infection of the southern cone rust, Cronartium strobilinum (Arth.) Hedgc. & Hahn, occurred in a slash pine, Pinus elliottii Engelm, var. elliottii, seed orchard near White Springs, Fla. Cone rust symptoms began to appear on first-year conelets in mid-April and by June up to 56% of the conelets were infected on each tree. Coneworms, Dioryctria spp., began attacking the rust conelets in mid May and by late June, when the conelets began dying, an average of 77% of the rusted conelets harbored from 1-13 larvae each. The numerous coneworms then attacked and killed up to 51% of the second year cones per tree. The cone rust not only killed a large portion of the first-year cone crop within the orchard, but apparently served as a medium for a temporary increase in the population level of coneworms. Combined, the cone rust and coneworms destroyed most of the first- and second-year cone crops within the orchard.

OAK WILT - WHY ARE THE VECTORS INEFFICIENT?

by
Charles O. Rexrode

Sap-feeding beetles, family Nitidulidae, and oak bark beetles, Pseudopityophthorus spp., are believed to be responsible for most of the overland spread of the oak wilt fungus, Ceratocystis fagacearum (Bretz) Hunt.

Nitidulids meet all the requirements for a vector. However, they are dependent on fungus mats that form pressure cushions and crack the bark on the diseased tree for a source of inoculum. They are also dependent on fresh wounds, usually less than 24 hours old, on healthy oaks for successful inoculation and infection.

Oak bark beetles, Pseudopityophthorus spp., are tree-wounding insects that satisfy all requirements for a vector of the oak wilt fungus. Although oak bark beetles naturally breed in diseased oaks, most studies indicate that only a small percentage of beetles emerging from wilt-killed trees carry the fungus. There are several possible explanations for the apparent low incidence of beetle contamination, thus a low incidence of oak wilt transmission. The oak wilt fungus rarely fruits in diseased trees. Fungus longevity in the bole and crown of infected trees of the red oak group rarely exceeds one year, and is often much shorter, particularly in the branches where bark beetles commonly breed. Also, fungus distribution is irregular in many diseased trees.
ASSOCIATION BETWEEN ANNOSUM ROOT ROT 
AND THE SOUTHERN PINE BEETLE

by

S. A. Alexander

Department of Plant Pathology and Physiology
Virginia Polytechnic Institute and State University

The association of Heterobasidion annosum and the southern pine beetle (Dendroctonus frontalis) (SPB) was determined in plantations and in natural, undisturbed stands of loblolly pine. Mean severity levels for H. annosum in SPB and control plots in plantations were 23.1 and 10.9 % (P=0.05), respectively. Mean severity levels of H. annosum in SPB and control plots in natural stands were 12.0 and 0.1 % (P=0.02), respectively. A significant and consistent association between the increased severity of annosum root rot and SPB infested loblolly pine was found in thinned loblolly pine plantations established on sandy coastal plain soils. The association of H. annosum with reduced radial growth in loblolly pine infested with SPB has also been studied. Trees infested with SPB produced an average of 6 % radial growth over the last 5 years in thinned loblolly pine plantations as compared to noninfested control plots (P=0.05). Within the plots infested with SPB located in thinned plantations, the SPB-infested trees produced 28 % less radial growth for the last 5 years, respectively, as compared to the noninfested trees (P=0.01). Mean H. annosum colonization of excavated root systems in SPB-infested and noninfested trees in the SPB plots were 54 and 11 % (P=0.0001), respectively. It was concluded that loblolly pines preferred by SPB were being stressed by H. annosum prior to SPB attack and that this stress was being expressed through reduced radial growth. Annosum root rot was found to be a major factor in increasing the susceptibility of trees in thinned plantations located on high hazard annosum root rot sites to attack by SPB.
WORKSHOP:

PEST MANAGEMENT PRACTICES AND FOREST MANAGEMENT

Moderators
Roger P. Belanger, USFS Southeastern Station
Fred P. Hain, North Carolina State University

Success and problems associated with the implementation of pest management practices were discussed by pest management specialist and forest managers from state organizations and industry. Participants were: Walt Beers, Jr., Buckeye Cellulose Company, Perry, Florida; Coleman Doggett, N.C. State Forest Service, Raleigh, North Carolina; Sue Goldman, International Paper Company, Bangor, Maine; and Bill Williams, North Carolina Forest Service, Raleigh, North Carolina.

Pest Management Programs:
Problems with Implementation
In State Forestry Organizations

by
Coleman A. Doggett

Both internal organizational constraints and external constraints and considerations govern implementation of research recommendations by state forestry organizations. From an internal organizational standpoint, most state pest control personnel act in a staff capacity. Consequently, they act in an advisory capacity and have no direct control over line personnel. Also modification and/or additional information is usually needed to fit a research recommendation into an operational framework. External constraints and considerations include:

1. Lack of control of resource - Most forest lands in the southeast are not owned or controlled by state organizations. The small private landowners who constitute the bulk of our constituency are very independent and diverse. They may or may not follow recommendations.

2. Needs and effects on affected constituencies must be considered. For example, the effect of an action on wood using industry.

3. Political considerations - Either legislation or political pressure may dictate the direction of pest control action.
Although these constraints and considerations must be addressed, if practical research recommendations are presented, they will be effectively implemented. Implementation is generally most effective on areas over which state organizations have direct control such as state forests, nurseries, and seed orchards. However, a number of very successful control programs have been implemented on private lands.

Pest Management Programs: Success and Problems With Implementation; An Industry Perspective

by

Suzanne F. Goldman

Pest management activities at International Paper Company are primarily research oriented. The program encompasses entomology and pathology and is five years old.

Since the economic losses associated with seed and cone insects had been demonstrated, initial research efforts were in this area. As the research project matured, project direction was changed and emphasis rechanneled into spruce budworm and reproduction weevils.

Most forest entomology research in International Paper interacts with operations. Options exist to have a research project totally performed by research and just acknowledged by operations to projects that are a completely joint effort.

Our greatest successes to date in forest entomology have been with the spruce budworm and reproduction weevils. Our spruce budworm research project is a cooperative effort with operations. In this instance the project was developed jointly. Research was responsible for the coordination and evaluation of the study while operations installed the treatments. Throughout the whole process both groups worked cooperatively toward a common goal.

In the case of the reproduction weevils, research alerted operations to a problem they had been unaware of previously. Now that operations acknowledges the problem, research is working with them to try to minimize its impact.

Although we have continued operational research and implemented new control strategies, research in the seed orchards was not as successful as budworm or weevil work. A large part of this problem was due to the conflict between the operational requirements of the orchards and research needs.

In addition to actual research, research personnel are involved in some technology transfer activities. Pest management workshops have been performed for field personnel and additional workshops are planned in the future. Additionally, pertinent pest management literature is transmitted to the field people to keep them abreast of developments in the research community.
Implementing Pest management Practices Through Forest Management

by

W. D. Williams

Policy pertaining to forest management at the State level must be broad to cover a large range of different conditions and landowners' objectives. In North Carolina we do not have legislative authority to mandate compliance (by private landowners) with our recommendations.

In working with owners, our foresters take several factors into consideration in making silvicultural recommendations. Such factors are: (1) potential pest problems, (2) site capabilities, (3) species possibilities, (4) markets, (5) stumpage prices, (6) costs to the owner, and (7) owner objectives. The combination of influences of these factors will determine the silvicultural practice that is used.

Industrial Pest Management

by

Walter L. Beers, Jr.
Lands and Timber Research Manager
The Buckeye Cellulose Corporation, Perry, Florida

Components of an effective pest management program for commercial forests include (1) knowledge of pests and damage symptoms; (2) incidence and impact information; (3) timely pest detection; (4) knowledge of predisposing factors; (5) periodic training sessions; (6) tight coordination with pest management specialists; and (7) implementation of known pest management strategies.

Major contemporary pest problems in pine forests of the north central Gulf coast of Florida are: fusiform rust; annosus root rot; flower, cone, and seed insects; cone rust; sawflies; bark beetles; pitch canker; and sand pine decline.

New challenges to pest managers will result from site changes due to recropping, early stress in dense plantations established for biomass production, introduction of exotic species, and use of new regeneration techniques such as fluid drilling.
WORKSHOP:
Behavioral Chemicals to Manipulate Forest Insect Populations
Ronald F. Billings and Carl Fatzinger, Co-moderators

This workshop consisted of a series of short presentations on the theory and application of behavioral chemicals for manipulating forest insect pests. Wayne Berisford was scheduled to speak on pine tip moth pheromones but was unable to attend the meeting. In his stead, Steve Cade (Weyerhaeuser Company) briefly summarized recent field tests with synthetic pheromones to disrupt mating activities of tip moths in Arkansas pine plantations. Trap catches were reduced significantly but damage levels in treated plantations remained unchanged.

John Alcock (Arizona State University) presented a stimulating theoretical discussion of bark beetle communication and the role of behavioral chemicals in host selection and species survival. He used the Douglas-fir beetle as an example.

Scott Cameron (Texas Forest Service) discussed the recent isolation and identification of pheromones for several coneworm species (Dioryctria) in southern pine seed orchards. Pheromones have now been identified for D. amatella, D. clarioralis, and D. disclosa. He also suggested how pheromone systems and behavioral traits of several sympatric Dioryctria species interact to assure species integrity. The potential uses of pheromones for manipulating coneworm moths in seed orchards also was discussed.

On behalf of Tom Payne (Texas A&M University), who was unable to attend the meeting, Ron Billings discussed recent progress in the use of frontalure for disrupting active infestations of southern pine beetle. Due to low beetle activity in Texas, the most recent field trials were conducted in Georgia. Results were encouraging; spot disruption was obtained in 2 of 3 treatments. The development of practical sustained release deployment systems is in progress. Further pilot tests of spot disruption with synthetic frontalure await the detection of suitable active SPB spots.

Carl Fatzinger (U. S. Forest Service) discussed on-going studies to evaluate the effectiveness of host-produced volatiles for trapping out black turpentine beetles and Ips engraver beetles in naval store areas. First-distilled pine turpentine deployed in baited water traps appears to attract sufficient numbers of beetles to significantly reduce damage levels.

Finally, Ron Billings (Texas Forest Service) described the results of field bioassays with synthetic bark beetle pheromone mixes. The bark beetle predator Thanasimus dubius responded in greatest numbers to traps with frontalure, the southern pine beetle pheromone. The presence of SPB inhibitors brevicomin and verbenone significantly reduced the response of this predator to frontalure. In contrast, the predator Temnochila virescens and sawyers of the genus Monochamus showed preferences for synthetic Ips pheromones and were not attracted to pheromones of the southern pine beetle. These associates were largely unaffected by the presence of southern pine beetle inhibitors. The implications of these findings to previously observed temporal patterns of host tree colonization were discussed.

A question and answer period followed the formal workshop presentations.
Dr. R. C. Wilkinson. Professor of Forest Entomology, University of Florida:

"Given the choice, try to select an economically important problem or pest species to work on. It doesn't hurt to consult with experienced forest managers and entomologists to find out how they would rank the relative importance of an array of local pest species. Select a current or potential problem that fits your current or projected capabilities. Some problems are best attacked by a team of specialists with wide-ranging capabilities. You and your research team must become "instant experts!" in the research area you have chosen; be sure to take advantage of modern information retrieval systems such as FAMULUS (bark beetles) and SOUTH-FORNET.

Ask for adequate funds to meet the needs of your intended research. It goes without saying that the quality of your research will also be greatly affected by the adequacy of your facilities, equipment, and personnel - get the best you can afford. To keep support coming in, pass on your findings in usable form as soon as possible. Research is expensive and funds must be accounted for or they will dry up.

Perhaps 90% of the real or imagined barriers to research success are "people" problems, not "technical" problems. You must build a program such that administrators develop a consistent and positive attitude towards it. It may help to place your program in perspective by deciding whether you are on the lower, middle, or upper end of a sigmoid curve in respect to progress. Each part of this curve calls for a somewhat different set of responses. You will often need extreme patience and extra effort to get started. The middle part is the fun part and every effort should be made to keep it as long and straight as possible. The upper part of the curve is sometimes difficult to recognize and may require that research be summarized - while simultaneously figuring out what problem to tackle next.

Overcoming barriers is the business of science in its task of unlocking an apparently infinite series of related questions and answers. With this kind of background, it is not surprising that scientists become quite adept at overcoming barriers of every sort."
A. I. Boone. Entomologist, South Carolina Forestry Commission

Being a practicing forest entomologist rather than a research entomologist, I am not quite sure how to address this topic. For purposes of summary, I would say that too much money is spent on forest insect research that has no practical application. However, basic research is important as a support to operational programs. Research should address new problems, not rehash old ones. Money should usually be allocated to projects with favorable cost benefit ratios, but originality and previous research performed should be factors considered in funding. All research proposals should address dissemination of findings prior to their consideration for funding. Also, to avoid duplication of efforts, close communication between researchers is important.

Dr. H. V. Toko. Staff Director, Forest Pest Management, USDA Forest Service, Southeastern Area, State and Private Forestry

The image of Forest Insect Research as perceived by many forest resource managers and administrators is poor. Outputs from research are viewed as being of little benefit and value to improving practices that will ultimately produce fewer losses from forest insects. The research (1) continues to refine techniques, (2) reinvents the wheel, (3) duplicates similar work being done in other areas, (4) performs research that is of little practical use, and (5) refuses to make recommendations until the last "i" is dotted. Whether these images are real or imagined, they do exist. There is a psychological block to strong support of forest insect research projects.

Uniroyal approach to better identifying projects as described in an editorial in Research Management appears to be applicable for most forest insect research projects. The project selections are based on (1) probability of success in a reasonable period of time, (2) marketability of product, (3) resources available - not only to develop, but also implement findings, (4) priority based on inputs from users, and (5) an action plan which includes criteria for shutting down a project.

A somewhat modified approach could be used to better identify resource managers' needs before forest insect research is undertaken. Although some aspects of the suggestions have been currently undertaken, a more intensive effort is needed. The general format suggested is: (1) work more closely with the forest resource managers to identify their needs, (2) identify how the new approach will benefit the land manager as compared to the old, (3) is it cost-effective?, and (4) is it practical? Resource managers cannot be expected to adopt procedures that are labor intensive or require substantial increases in the data needed to implement the work.

How can the image of forest insect research be changed and overcome the physical/economic barrier?

1. Increase salesmanship. Identify user more effectively and listen to his inputs before undertaking research.
2. Work toward making research more useable by the land manager. Some basic research is needed but a better balance with applied work may be necessary. Through demonstration and pilot projects, show users how to implement new procedures.

3. Better identifying outputs, especially benefit/cost if the research is implemented. Show dollar savings.

4. Develop industry oriented group such as the Pest Action Councils in the western United States to gain greater support for research. The IPM cooperative in Florida could be considered as an organization of this type.

We need to meet with users, listen to them and work toward greater understanding of what we are trying to do to assist them in their problems. We can overcome some of the physical/economic barriers in this way.

Dr. T. Evan Nebeker. Associate Professor of Forest Entomology, Mississippi State University

Four basic problems face researchers in the university system.

1. The problem of questions
2. The problem of accomplishment
3. The problem of economics
4. The problem of access

Formulation of the right question is important. How it is formulated is critical. A question such as "How many insects are in the forest?" is a useless question. What is a niche? Also a useless question, but may be a good point of view, possibly a unifying concept in ecology. Questions, theories, or hypotheses that cannot be tested are phantom questions which many are in pursuit of. The problem of accomplishment is tied in directly with the type of questions one may choose to ask. Especially with the win something today attitude resulting in cute questions rather than meaningful questions. Further, in the university system we are evaluated from both a basic and applied point of view. Our basic findings may not be applicable today but in the future. What are we to be evaluated on. If it is not applicable today, is the work meaningful? How are our researchers evaluated with so many evaluators? The problem of economics is with everyone. A proper question will dictate the resource needs.

Once we have a real question in mind it will satisfy our peers and we have the money to carry out the work, the problem of access comes up for the field oriented scientist. For example, many of our cooperators are willing to work with us in thinning projects where growth and yield type data, etc., can be obtained. But once you add in a dimension such as following thinning we would like to introduce bark beetles into the system then the cooperators become less cooperative, hence access to their lands may be limited because we are imposing a danger. Hence, the problem of access. This is true for other areas.
WORKSHOP:
PESTICIDES: ENVIRONMENTAL CONSIDERATIONS AND USE

John W. Taylor, Jr., and Felton Hastings, Co-Moderators

Daniel G. Neary (USDA Forest Service, Franklin, North Carolina) reported on the fate of carbofuran in a watershed. Carbofuran granules were applied to a lower Piedmont loblolly pine seed orchard by subsurface drill in February 1981, and Guthion was aerially sprayed in April. Both insecticides control seed and cone insects, primarily Diorystria spp., a frequent cause of seed crop losses. Insecticide movement in storm runoff was measured using flow-proportional, discrete automatic, and gravity stage samplers. Soil samples and tension lysimeters were used to monitor subsurface movement in a typical Hapludult soil. Carbofuran residues appeared in the first stormflow from a watershed with a significant area of compacted soil. Another watershed previously treated with carbofuran did not produce any residues until the fifth storm. Carbofuran levels peaked at 1,270 and 7,820 ppb during a low volume runoff event. Soil water did not contain carbofuran residues until the fifth storm. Guthion residues deposited during the aerial application declined rapidly with distance from the stand edge and were, at worst, only 10% of the 96-hour LC50 for sunfish in an adjacent lake. Guthion peaked in storm runoff at 1,540 ppb and then declined during subsequent storms.

Gene Brady (University of Georgia, Athens, Georgia) reported on non-target effects, metabolism and mobility of lindane in mountainous terrain. Lindane (0.5% EC) was applied at the rate of three gallons per tree to the bole of white pines (approximately 6 in d.b.h.) at Coweeta Hydrologic Laboratory near Franklin, North Carolina. Analyses by GLC indicated that lindane was more persistent in soil and litter (samples within the drop line area) than in bark. Less than one percent lindane was metabolized in bark at 240 days posttreatment according to GLC analysis conducted by Dr. Robert Chadwick at EPA in Research Triangle Park, North Carolina. Comparative analyses between radiolabelled versus non-radiolabelled lindane revealed that lindane binds to bark and is significantly more persistent than indicated by standard GLC analyses. Lindane did not move a measurable distance downslope from treated sites. Mesofaunal populations (primarily collembolans and mites) in soil and litter were reduced from 10 to 20 percent of control up to 1-year posttreatment. Population densities of these arthropods increased at 2 and 3 years posttreatment to levels approaching that of controls.

Felton Hastings (USDA Forest Service, Research Triangle Park, North Carolina) presented a high performance liquid chromatographic technique, developed by Alice S. Jones, for direct analysis of aqueous samples of carbaryl and a-naphthol at the parts-per-billion level. The utility of SEP-PAK™ cartridges (Waters Associates) for storing field collected aqueous carbaryl samples was demonstrated. Samples can be stored on cartridges at ambient temperature for 5 days with subsequent recoveries of 98 and 89 percent for carbaryl and a-naphthol, respectively.
John Taylor (USDA Forest Service, Atlanta, Georgia) reported on recent changes in pesticide registration. Several recent changes in pesticide registrations have occurred. Guthion 2F is replacing the 2S and 2L formulations. Guthion 2S and 2L have been registered for low volume aerial application. Pydrin (fenvalerate), Ambush (permethrin) and Imidan (phosmet) are being proposed for registration on pine seed orchards. Several useful new references for assistance in choosing pesticides for use in forest situations are available.

Gene Brady presented data developed by Wayne Berisford (University of Georgia, Athens, Georgia) Bob Turnbow, and himself in which they found that attacks by the southern pine beetle, Dendroctonus frontalis Zimmermann, can be prevented on southern pines by applications of Tindane or Chlorpyrifos to the entire bole and to the top half of the bole only. Treatment of the basal two meters and the lower half of tree boles does not prevent attacks.

By applying toxicants to only the top half of trees, insecticide volume is reduced by over 30% and contamination of nontarget areas near the base of the trees is significantly reduced.

Gary DeBarr (Southeastern Forest Experiment Station, Athens, GA) has been working with two pyrethroid insecticides, permethrin (ambush) and fenvalerate (pydrin). The insecticides have been evaluated in both laboratory and field conditions for the past 5 years to determine their potential usefulness in seed orchard pest management. The relative toxicities of both insecticides to the leaf footed pine seed bug, Leptoglossus corculus, and the southern pine coneworm, Dioryctria amatella, were found to be equal to or better than azinphosmethyl, the insecticide currently registered for these pests in southern pine seed orchards. Efficacy was demonstrated in a series of tests utilizing both ground and aerial application techniques. Rates of active ingredient per acre were only one-tenth to one-fourth those required for control with azinphosmethyl. The pyrethroids have favorable cost-benefit ratios, persistence and low mammalian toxicities, but outbreaks of mealy bugs and scale insects associated with their use of concern. Registrations for seed and cone insects are expected within the next year.
Natural enemy enhancement was viewed from four perspectives: (1) Howard Whitcomb - U. Fla., Gainesville - discussed studies on row crops and weeds to illustrate the importance of rigorous field work and an open-minded attitude. (2) Vicki Fedde presented a paper for her husband, Gerhard Fedde - SE Forest Experiment Station, Athens, GA - concerning egg parasites of the seedbug, Leptoglossus cucurullus. His description of experiences with field collection and laboratory propagation ended with the caveat: "...abandon all preconceptions about what constitutes a 'good' or 'bad' parasite....We simply know too little ...." (3) Louis Kudon - U. GA, Athens - explained some of the interactions among bark beetle parasites and their hosts at varying population densities, particularly the relationship between host preference and alternate host availability. (4) Louis Tedders - USDA, SEA, Byron, GA - described and illustrated his efforts to increase biological control of aphids and other pests of pecan, particularly through the management of orchard ground cover.

Although it was not planned or articulated, a consensus emerged: the complexity of parasite/host interactions is overwhelming; rigorous field studies and openmindedness are two of the requisites for progress toward controlled enhancement of natural enemies.
WORKSHOP:
Aerial Survey and Remote Sensing

William A. Carothers and William Clerke, Co-Moderators

Mike Remion, Insect and Disease Specialist, South Carolina Forestry Commission, began the session by explaining aerial survey procedures in his State. During years when the southern pine beetle populations are at endemic levels, three flights are made, one winter and two summer flights. Black and white aerial photos at a scale of 1:1320 are used to locate active infestations. When beetle populations are high, flights are made once a month. Mike explained that contract aircraft, usually Cessna 172's are used on these detection flights.

Joe Pase, Entomologist, Texas Forest Service, spoke on his organization's approach to southern pine beetle detection surveys. Joe indicated that routine flights are conducted in early summer, mid-summer and early fall during periods of endemic southern pine beetle populations. When populations are epidemic, more frequent flights are conducted. Unlike South Carolina, Texas uses USGS 15 minute quadrangle sheets to sketchmap. Joe stated that they have black and white photos at a scale of 1:15,840 but use them to update their quadrangle sheets rather than on surveys. The majority of their detection flights are done from contract aircraft. However, reconnaissance flights to get a general overview of conditions are periodically conducted using a Texas Forest Service aircraft equipped with a Loran-C navigation system. Joe emphasized that the Loran-C unit has been very beneficial to their aerial photo acquisition capabilities as well.

Emmett Wilson, Aerial Survey Team member, USDA Forest Service, illustrated various methods of conducting aerial surveys. In addition to using aerial photos, different kinds and scales of maps can be used to effectively spray target areas. Emmett explained how flight lines can be spaced on maps to achieve the desired intensity of coverage on surveys. He also stated that the Forest Service flies 25%-50% coverage on routine detection surveys and 100% coverage on areas where biological evaluations are planned. Emmett suggested flying contour flight lines in mountainous areas to improve the accuracy of detection flights.

William Clerke, Remote Sensing Specialist, USDA Forest Service, presented the remote sensing portion of the workshop. In his first presentation, Bill described the KA-80A panoramic reconnaissance camera system being flown in support of Forest Service activities aboard a NASA U-2 aircraft. The 24" focal length camera records on image 17 miles on either side of the aircraft on a film image 4.5 by 50.26 inches. Scale of the panoramic imagery varies both along track and across track as a function of the panoramic camera's scan angle out to a maximum of 60 either side of nadir. At nadir, directly under the aircraft the imagery has a scale of 1:30,000. Advantages of the system include rapid coverage of very large areas, synoptic view and high resolution (30% greater than 1:24,000 resource photography). Disadvantages include
uncertain future availability, unwieldy format for field work, availability of imagery only as transparencies and the difficulty of making area measurement because of the panoramic distortion. An effective multistage survey based on the use of this imagery has been developed for estimating the damage caused by the mountain pine beetle. Grids and field viewers have been developed to overcome the disadvantages of the format. The Forest Service Nationwide Forestry Applications Program is currently using the imagery to develop interim update procedures for the renewable resource evaluations conducted by the Forest Experiment Stations. In the Southeast, imagery is available for eastern Oklahoma, east Texas, Louisiana, most of South Carolina and portions of Alabama, Mississippi and Georgia. Imagery from this system, along with 1:56,000 CIR frame photography acquired under the new USGS National High Altitude Program, were set up for viewing by participants.

Bill's second presentation described work being conducted under a cooperative project with the Georgia Institute of Technology Engineering Experiment Station to evaluate the utility of satellite digital imagery as a supplement to aerial photography for forest pest management and other S&PF activities. Images produced on the minicomputer based analysis system being implemented as part of the project were shown. The system will include a geographic data base capability to permit ancillary data such as soil and topography to be combined with photo and satellite imagery interpretation. The integrated analysis capability being implemented under the project will greatly facilitate hazard rating the conduct of loss surveys over extensive areas.
WORKSHOP:  

Economic Law vs Protection  

John F. Godbee, Jr., Mike Remion, Moderators

The workshop consisted of 4 semiformal presentations followed by group discussion.

John Godbee, Pest Management Specialist, Union Camp Corporation opened the workshop with an overview of pest management and the criteria that must be evaluated before the implementation of operational pest management programs on industrial lands.

Roger Belanger, Principal Silviculturist, USFS, defined the purpose of silviculture as producing and maintaining a forest that best fulfills the objectives of the landowner. He stressed that protection is an important part of this management function. Presentation strategies were discussed in relationship to the Southern pine beetle, integrated pest management, and thinning. Silvicultural guidelines developed to reduce losses from forests pest must be effective and efficient. Growth and yield dates and production values are required before benefit/cost analyses may be developed to determine which course of action may be best suited to individual stands and ownerships.

Mike Vasievich, Research Economist, USFS, presented an economic assessment of forest protection investments. Mike pointed out that economic analyses of treatments to protect forest stands from losses are necessary to assure that these investments are competitive with other options available to the landowner. Changes in the way the forests are managed to reduce losses from pests may not prove to be worth the costs and should not be based on emotional appeal with little or no documentation to support the cost of the investment. Once a financial evaluation has been made, it must be compared with 4 basic options before a decision to implement can be made. These investments should (1) show acceptable and profitable returns, (2) reduce the economic risk, (3) provide an acceptable distribution of costs and benefits, and (4) be acceptable for environmental, cultural or other resources. Developmental and decision criteria was presented for evaluating the consequences of investing in some pest management treatment. Mike stated that economic, pest and management impact data should be combined to produce several scenarios for different levels of activity and treatments. A set of cash flows should be developed for each case and then discounted for cost/benefit analyses. The financial consequences would then be available for combinations of treatments from a passive do nothing approach to broad scale treatments following severe activity.

Charlie Johnson, operations analyst, Union Camp Corporation, presented a synopsis of economic problems in implementation. Charlie pointed out that silvicultural guidelines resulting from pest management research can rarely be economically applied to large geograpical areas, but may be very important in areas where there is a high probability that the pest will strike. A procedure to determine the breakeven point of management was discussed for
the Southern pine beetle. It was determined that the probability of attack must be greater than 1:33 before preventative silvicultural treatments are economically feasible. Charlie stressed that the culmination of pest research must be the establishment of probabilities of loss based on easily measured site characteristics and statistics.

Roy Hedden, Entomologist, Clemson University, presented the results of an evaluation of the economic impact due to pales weevil and Nantucket pine tip moth attack under varying forest management regimes for loblolly pine. The management options compared were pulpwood, pulpwood plus Chip-N-Saw, and sawtimber production. The sawtimber regime included intermediate thinnings at ages 16 and 23. Rotation age for all options was 30 years. Results for site indexes 54 and 58 (base age 25) and discount rates of 6 and 12 percent were presented.

A modification of the land expectation value (Paustman's formula) method of valuation was used in the analysis. Only timber benefits were considered. Perpetual rotations were always assumed. All results were for before tax values with land values of zero. The effects due to inflation were not directly considered.

Pales weevil impact was evaluated as the cost of delaying regeneration for one year. Present value losses per acre due a delay in regeneration increased from approximately $10 for the pulpwood management option to $50 for the sawtimber regime (SI = 54, discount rate = 6%). An increase in the discount rate resulted in a reduction in the estimate of impact. Estimates of losses increased as site index increased. In general the results of the analysis indicated that immediate regeneration should be favored whenever short rotation sawtimber is the management objective. Current pales weevil control cost of $3 to $16 per acre are always less than the losses due to delaying regeneration.

Impact from tip moth attack was estimated to be three to five cords per acre, or a reduction in site index (25 year base) of two to four feet. Comparisons were made for the same three management regimes outlined above. Discount rates of six and twelve percent were compared. Results showed that the present value loss per acre increased from $14 for pulpwood management to $96 for sawtimber production (6% discount rate). The implication of these results are unclear at this time due to a lack of information regarding control costs and strategies for the Nantucket pine tip moth.

The workshop was concluded with a group discussion on problems of implementation.
WORKSHOP

IMPACT AND CONTROL OF SEED AND CONE INSECTS

R. Scott Cameron and Terry S. Price, Co-moderators

The presentations given by invited participants were introduced by Scott Cameron (Texas Forest Service, Lufkin, Texas) in the context of southern pine seed orchard pest management. The current neophyte status of this concept in southern pine seed orchards likely will limit improvement of insect control in the near future to areas such as maintaining crop inventories and monitoring losses, determination of key pests, development of methods for monitoring the presence and seasonal abundance of key insect pests, improving present methods of control and integration of new control strategies with present control methods.

Julie Weatherby (USDA Forest Service, Pineville, LA) compared pest management programs in southern pine seed orchards with the more advanced programs in apple orchards. Like apple orchardists, seed orchard managers will be relying on insecticides, and efforts must be directed toward integration of other control tactics around frequent insecticide applications. Pest management programs for both seed orchard and apple orchard ecosystems must be directed at a complex of pests. Monitoring systems, economic injury levels, economic thresholds, treatment alternatives and evaluation systems must be developed for the major pests.

The evaluation of seed orchard performance and planning for both cone harvest and nursery planting can be improved through the implementation of an adequate inventory monitoring system. John Godbee (Union Camp Corporation, Rincon, GA) described a system which has been developed and implemented for monitoring cone and seed crops in slash and loblolly pine seed orchards. The total numbers of flowers are determined for selected trees and sample cones are observed periodically throughout development to monitor mortality by causal agent. Based on survival of sample conelets, the numbers of cones and seeds expected at cone harvest can be predicted up to 18 months in advance. Problem areas are thus identified and the economic feasibility of additional management practices and costs can then be balanced against the expected seed and seedling yields.

Gary DeBarr (USDA Forest Service, Athens, GA) reported on the status of research on the identification of coneworm (Diorystria spp.) pheromones. The major components of the pheromones of D. amatella, D. clarioralis and D. disclusa have been identified and field tested. Pheromones represent a potential method for monitoring coneworm populations for timing insecticide treatments and possibly for reducing coneworm populations through mating disruption. Currently, studies are being conducted to test these methods for D. disclusa.

The use of bacteria for the control of coneworms in southern pine seed orchards was discussed by Paul McLeod (University of Arkansas, Fayetteville, AR). Field and laboratory tests are being conducted to investigate the
efficacy of Bacillus thuringensis for the control of D. amatella in loblolly pine seed orchards in Arkansas, Louisiana, and Oklahoma. Applications of B. thuringensis have reduced coneworm damage in several field tests and studies are underway to further evaluate these treatments.

In the absence of her husband Gerry, Vicky Fedde (USDA Forest Service, Athens, GA) reported on the prospects of using a group of native egg parasites against the pine seed bug Leptoglossus corculus. The species currently being studied are Gryon pennsylvanicus (Scelionidae), Anastatus reduvií (Eupelmidae) and Ooencyrtis trinidadensis (Encyrtidae). In laboratory colonies the reproductive efficiency of the former two species has been improved to a 16:1 ratio of females to males. The breeding potentials of O. trinidadensis and G. pennsylvanicus are sufficient to keep pace with anticipated multiple generations of L. corculus in the field. But the reproductive rates of these parasites in seed orchards will depend to a large extent on the type and quality of nourishment they receive in the field.

Larry Barber (USDA Forest Service, Asheville, NC) reported on the status of aerial applications of insecticides in southern pine seed orchards. Aerial applications represent an attractive alternative to ground treatments due to rapidity of application, reduced amounts of insecticide required and good distribution in the tops of seed orchard trees. However, difficulties in locating aerial applicators at a reasonable cost and landowner complaints may be encountered in some locations. Aerial applications of both Guthion® and Pydrin® in pilot tests conducted by the USFS in southern pine seed orchards have substantially reduced coneworm and seed bug damage.

A few minutes were devoted to questions and discussion after each presentation.
Nick Crookston, University of Idaho, spent about an hour discussing the stand prognosis model developed by Al Stage and colleagues in the USDA. Nick also explained how the insect submodels were linked to the prognosis model, what input data were needed to run the model and what sort of output resulted. Problems and successes as experienced by prognosis model users were brought out. The discussion was of an informal nature, with questions and comments from the participants interspersed with Nick's presentation.

Some discussion on the status of stand growth models and southern pine beetle population damage and prediction models followed. Subsequent discussion also centered on the applicability of using stand prognosis models in the south and linking insect models with them. Aspects of current modeling research at Duke, North Carolina State, Texas A&M and the University of Arkansas were included in later parts of the session.
MINUTES PRELIMINARY BUSINESS MEETING
SFINC--August 11, 1981

Meeting called to order by Chairman Hedden at 10:30 a.m.

Announced 125 registered attendance at this time.

John Foltz and Jim Richmond made several announcements concerning local arrangements and the workshop program.

Welcoming remarks were presented to the group by Dr. Vernon Perry, Assistant Dean of Research, Food and Agricultural Sciences, University of Florida.

Standing committee reports were received from Kenneth Jeane, Damage and Loss Committee, and John Moser, filling in for Forrest Oliveria on the Common Names Committee. A common name of Eastern Oak Looper was suggested for Phigalia titea (Cramer 1782). Larry Barber reported on the activities of the Photo Salon and Slide Series.

New business included a discussion of the Outstanding Contributions Award Committee by the 1981 Chairman, Steve Cade. Guidelines are not specific enough to allow intelligent selections. Dr. Cade followed the discussion with a motion to abolish the award. Following considerable discussion, the motion was amended to form a committee to discuss the situation and report back to the group at the final business meeting. The amended motion passed and a committee of past chairmen was appointed (Cade, Stephen, Nebeker, Mizell).

Ken Swain recommended that pest losses should be reported by State, using standardized methods of gathering and reporting information. Kenneth Jeane will pursue this need. Swain also offered a motion that Denny Ward should replace Amel Landgraf on the losses committee. The motion was passed.

Dr. Sam Alexander (VPI&SU) representing the Southwide Forest Disease Workshop, offered an invitation for the 27th SFINC to meet jointly with the plant pathologists in Blacksburg, Va. on June 8, 1982. The individual groups can meet independently on succeeding days.

Meeting adjourned 11:30 a.m.
MINUTES FINAL BUSINESS MEETING
SFIWC--August 13, 1981

Called to order by Chairman Hedden at 10:30 a.m.  
Final registration was 125 members.  

Report from Nominations Committee Chairman Bill Hoffard.  

Nominations for Chairman  
Ken Swain  
Fred Hain  
Evan Nebeker  

Nominations for Counselor to replace C. W. Berisford.  
Dave Drummond  
Jim McGraw  
Al Thomas  

Nebeker and McGraw elected.  

Slide contest winners were announced and presentations made by Larry Barber.  

Category 1. Insects  
First--D. J. Waters  
Second--Joe Pase  
Third--John Ghent  

Category 2. Insect Damage  
First--John Ghent  
Second--(Photo not marked.  
Third--Bill Hoffard  

Category 3. Essay  
First--Jim McGraw  
Second--Ron Billings  
Third--Jim McGraw  

Announcement was made by John Moser that Eastern Oak Looper was approved for  
Chagalia titae (Cramer 1782).  

Jim McGraw introduced a motion that the group should meet with the patholo-  
gists June 8-10 in Blacksburg. Motion passed. Fred Stephen will serve as  
Program Chairman.  

Outstanding Contributions Award ad hoc committee reported. Cade withdrew ori-  
original motion to abolish award. A new motion was offered that the award should  
be retained, and a committee should be assigned to revise and restructure the  
guidelines. Motion passed. The Committee also suggested that the award may  
possibly be renamed to avoid the wording "Outstanding Contribution." Fred  
Hain was appointed as chairman and will select a committee to work with him.  

Meeting adjourned 11:45 by Chairman Nebeker.
TREASURER'S REPORT
August 1980 - August 1981

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This is the 26th annual meeting of the Southern Forest Insect Work Conference and is the second time that the Conference has been held in the State of Florida. The first Florida meeting was also held in Gainesville, Florida, in 1965--our 10th meeting--on August 17-19. The chairman was R. R. Mason of the Hiwassee Land Company (our only industry-affiliated chairman) who resigned following the Conference because of his pending transfer to Corvallis, Oregon, with the U.S. Forest Service. C. L. Morris was elected to be chairman for the following year.

The Conference theme was "Forest Insect Population Dynamics." A feature of the meeting was a pre-conference workshop on forest acarology organized by J. C. Moser.

It was at Gainesville in 1965 that the Conference recognized the pioneering efforts of R. J. Kowal and L. W. Orr and conferred upon them honorary membership to the Conference.

A record of 82 were in attendance. Other officers included E. P. Merkel, secretary-treasurer; L. L. Hyche, R. C. Thatcher and L. A. Cambre, counselors; and H. O. Yates III, program chairman.

The social highlight of the Conference was an Hawaiian luau--stuffed pig and all--held by the poolside at the now defunct Holiday Inn Motel.

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