## Founders' Award Address

Dr. Gary Daterman received the 2004 Founders' Award, the 12th such award to be given since its inception. The Founders' Award is given to an individual who has made an outstanding contribution to forest entomology in the west. The award recognizes significant contributions in pest management, extension-consultation, research, and teaching. The Founders' Award is intended to show the appreciation from the peer group for excellence. Dr. Daterman amply fills the criteria of excellence.

Gary Daterman

Darrell Ross introduced Dr. Daterman.

### Career Ramblings

Dr. Gary E. Daterman, USDA-Forest Service, Retired

To begin, I want to say that I am deeply honoured to receive this award. This will most certainly be filed away in my memory as one of the highlights of my career. It is humbling to me because I am very much aware there are many of you at least as qualified as I am to receive this award. I do wish to thank Darrell Ross for nominating me, and all those that supported my nomination in any way.

My presentation today will begin with an explanation of how I came to be a forest entomologist, and then some discussion about what I remember as some of the most memorable events over the course of my career. My remarks are in chronological order and based on the major insects studied, significant research findings, and selected comments on items of human interest.

**Getting started:**

Most of my childhood years were spent in northern Illinois where a strong interest in nature was developed through the usual routes of fishing, hunting, amateurish attempts at making butterfly collections, and just general exploration of the great outdoors. This interest did not, however, manifest itself in a firm decision as to "what I was going to be when I grew up". In fact, during my first three years as an undergraduate at the University of California at Davis, I changed my major curriculum many times. Successively, I majored in pre-veterinary medicine, economics, geology, and finally (of all things) political science as a preparatory degree for entering law school. One year prior to my expected graduation from UC-Davis, I had settled on transferring to UC Berkeley the following year in order to pursue a law degree. It was at that point, however, that a small insect intervened.

I had spent three successive summer breaks working on a fire crew in Lassen National Forest in northern California. Our crew was part of the staff of the old Pit Ranger District, which has long since merged with the Hat Creek Ranger District. We were assigned to a fire camp some 20 miles south of Fall River Mills on the Pitville Highway. In those years, this so-called highway was either a mud hole or a dustbin, depending on the season. Our fire camp consisted of a bunkhouse and a cook shack with a side room that served as the foreman's quarters and office. We had no running water or electricity, but even though the amenities were minimal I have fond memories of card games, horseshoes, and softball games in which we used a pick handle for a baseball bat. It was in 1960, during my third summer at that camp, that we noticed many dead and dying young ponderosa pines around our buildings and grounds. Closer inspection of those dying trees showed boring dust being produced by small reddish brown beetles tunneling in the inner bark. These fascinating little creatures were soon identified as an *Ips* species of bark beetle by our camp superintendent, Ken Swain, a Junior Forester recently graduated from Oregon State University. Many of you will no doubt recognize that name as Ken eventually held various positions in the USFS Forest Health Protection branch, and recently retired as the Director of Forest Health Protection in Atlanta, GA.

As you may have guessed, it was no doubt that encounter with an *Ips* beetle that first set my mind on forest entomology, or something akin to it, as a career. Returning to UC-Davis at the end of that fire season saw me poring over college catalogs seeking graduate study opportunities where such a major was possible. The draw of the Pacific Northwest with its magnificent forests and outstanding fishing opportunities persuaded me to head north, and I was soon enrolled in

graduate school at Oregon State University. Funding for a graduate refugee from the liberal arts, however, was non-existent; and this necessitated many hours of working a checkout counter at the local Safeway store as a survival mechanism. Once again, however, a small insect intervened.

This time it was the Douglas-fir beetle. As luck would have it, I had enrolled at Oregon State University prior to the occurrence of a monumental hurricane, the so-called Columbus Day Storm of 1962. The millions of trees blown down in that storm literally "set the table" for the Douglas-fir beetle, and staged the obvious threat of a subsequent beetle epidemic. These conditions soon led to increased research funding for the forest entomology professors at Oregon State University at that time, Drs. Julius Rudinsky and Bill Nagel. By this time I had completed a few quarters of graduate work, and Dr. Rudinsky took a chance and hired me as a half-time research assistant to participate in work on his National Science Foundation grant. I emphasize that he took a chance because I was certainly still very much a neophyte student of forest entomology! I was, of course, very grateful, very happy to give up my job checking groceries, and extremely pleased to be "off to the races" in pursuit of a graduate degree in forest entomology.

**The Ambrosia Beetle, *Trypodendron lineatum* (1960's):**

My research topic for a masters degree was to determine the diurnal and seasonal flight patterns of resident bark beetle species. This was accomplished by periodic sampling of flying insect populations with the use of power-driven nets. These nets had previously been developed at the Boyce Thompson Institute by Peter Vité and his associates, and they were highly effective in yielding rich captures of diverse and numerous forest insects. After months of sampling plus the counting and sorting of captured insects, the work became somewhat routine, and I confess that my enthusiasm began to wane. Once again, however, a small insect intervened, and this time it was the lined ambrosia beetle, *Trypodendron lineatum.*

During one day of sampling I noted that a particular net was repeatedly capturing large numbers of this particular species. A closer look revealed the net was close to a small tree branch covered by white boring dust caused by this species. Although I had been assisting with Dr. Rudinsky's and Orlo Jantz's experiments with Douglas-fir beetle pheromone, this serendipitous experience with *T. lineatum* was what truly sparked my interest and enthusiasm in the power of pheromones to influence an insect's behavior. Some very simple experiments with the boring dust and with individual beetles confined in small log sections quickly confirmed that *T. lineatum* was producing a very potent aggregation pheromone, a new finding. As a result of this experience I was permanently sold on the potential of insect pheromones for pest management applications. As you all know, the chemical structure of the *T. lineatum* pheromone was later identified by Milt Silverstein, John Borden, and colleagues, and it has been developed and in commercial use in mass-trapping programs for many years.

**European pine shoot moth (1960's and 70's):**

Upon completion of a Masters degree at Oregon State University, I was very fortunate to land a job with the USFS Pacific Northwest Research Station, with my assigned duty station at the Corvallis Forestry Sciences Laboratory. This time it was the European pine shoot moth, *Rhyacionia buoliana*, that was responsible for my good fortune. As most of you are aware, this insect was introduced to North America from Europe, and to the Pacific Northwest by way of the Lake States Region of the United States and Canada. Its discovery in the Seattle and Spokane, Washington areas, in 1959, touched off more than a little panic in the forest industry, and among forest entomologists. As it turned out, that response was somewhat of an over-reaction. However, one of its immediate effects was increased research funding and additional positions in forest entomology. Once again, a small insect had played a pivotal role in the direction of my career aspirations. The series of events this time were especially fortuitous as I was permitted to use my research results for a PhD program at Oregon State. As in many life experiences there was also a downside to this chain of events. Namely, that I would need to apply my full attention to research on this new insect which meant dropping all my ongoing bark beetle research, to which I had become strongly attached. I was most reluctant to do this, and I expect those of you working with bark beetles would readily understand that reluctance for abandoning work on such fascinating creatures. Nevertheless, I was most appreciative of acquiring a full time research position at this early stage of my career.

My research efforts on the European pine shoot moth represented one increment of a cooperative US Forest Service and Washington State University project to develop a sterile male program for eradication of the insect from the Pacific Northwest. Notwithstanding what you might think about the need or feasibility for such a project, keep in mind the value of focusing research activities on any problem, and the increase in knowledge that can result, whether or not the particular results were expected or foreseen. Principal cooperators at Washington State included professors Bob Harwood and Alan Berryman. One of my first assignments was to devise a caging device that would ensure that reproduction would occur under laboratory conditions. Certainly there was a clear need for the project, as mating was a prerequisite for evaluation of sterilization approaches, and also to perpetuate a laboratory colony of the insect. This problem was eventually solved, although not without some difficulties. Of primary value to me were the insights gained regarding the influence of the sex pheromone for mating to occur under any conditions, and the related value for developing a laboratory bioassay to evaluate potential pheromone components.

It was about 1970 when Dr. Doyle Daves and his colleagues in the Chemistry Department at the Oregon Graduate Center in Beaverton, Oregon entered the fray on European pine shoot moth, and a concerted effort to identify the insect's sex pheromone was initiated. We were successful in this effort and the identity of a new insect pheromone was published in 1974. This compound plus the addition of a second pheromone component later reported by Tom Gray and

others is now used in BC, CA, and the Pacific Northwestern States to detect the insect's presence in and around commercial nurseries and Christmas tree plantations in order to define infested areas warranting quarantine to reduce further spread of the insect.

Certainly one of the highlights of the European pine shoot moth research was the successful identification of its pheromone, and the subsequent development and application of the pheromone for detection surveys. This was not only a research achievement, but also a successful demonstration of effective teamwork among many organizations. The technology for chemical analysis used at the Oregon Graduate Center in the early 1970's required a comparatively large quantity of insects, and roughly 40,000 female moths were collected and processed to accomplish the extraction and collection of the active pheromone component needed for analysis. These collections required the combined efforts of entomologists and seasonal workers from ODF, WDNR, USFS-PNW, USFS-FPM, and WSU Agric. Experiment Sta. facilities in Puyallup, WA.

I can recall many excursions around the city of Seattle to collect infested pine shoots, or to observe moth behavior, as the insect was most readily found on ornamental pines in parks, golf courses, around churches, cemeteries, and other such landscaped locations. Our activities often drew curious stares, questions, and in some instances, rather derisive comments about what we were doing. I recall one early evening when several of us were wandering around Volunteer Park observing flight and mating behavior of the moths. We even had a couple of insect nets in evidence, and no doubt made quite a picture as we closely studied the pine branches in the twilight hours. A few of the more curious onlookers would occasionally ask questions, and my supervisor at the time, Val Carolin, was most willing to describe our work with emphasis on terms like mating behavior, sex pheromone, sterile male technique, and so forth. No doubt those instances served to raise eyebrows even further. I have always thought there was a certain irony in my having to work so much of my first assignment in metropolitan Seattle, considering that one of the primary attractions for my pursuing a career in forest entomology had been the expectation of working in forested areas far removed from cities.

Although the identification and development of the shoot moth's pheromone was very gratifying, some other work on *Rhyacionia buoliana* was also very personally rewarding. There had always been a question about the potential for the insect to spread within the western pine zone, as that potential was most relevant to the economic impact the insect might cause. Based upon studies of historic weather records for the West, some intensive laboratory evaluations of the effects of low humidity, and field observations of the insect caged on ponderosa pine saplings located within the pine zone south of Bend, OR, we developed estimates of where the shoot moth was most likely to become established in western North America. Those areas were delineated some 35-years ago, and to my knowledge the predictions have generally held up. I recall that the fieldwork for this evaluation also drew some rather pointed comments from the curious! To gain approval from the Oregon Dept of Agriculture to study

the survival of eggs and larvae within the pine zone, we were required to fence infested pine saplings with a six-foot chain link fence topped with three strands of barbed wire. The purpose, of course, had nothing directly to do with the insect, and everything to do with keeping curious passersby from possibly moving infested branches elsewhere and causing a new infestation. The local contractors that put up this 60 X 30-ft fence, had great fun asking me how far and fast I expected the trees to move, where I expected them to go, etc.

**The Douglas-fir Beetle (1970's):**

In the early 1970's, at about the time European pine shoot moth work had culminated, I was handed the opportunity to work on a large cooperative evaluation of methylcyclohexenone (MCH), the anti-aggregative pheromone of the Douglas-fir beetle. Mal Furniss of the USFS Intermountain Research Station was to head the study and establish and maintain Idaho plots, Galen Trostle would look after Utah plots, and Pete Orr, USFS-Region 6, and I, would establish and maintain plots in western Oregon and Washington. Other key cooperators on this study included Julius Rudinsky from Oregon State University, LeRoy Kline from Oregon Dept of Forestry, Leon Pettinger from USFS-Region 6, and Mark McGregor from USFS-Region 1. The study was designed to evaluate the capacity of MCH to prevent infestation of felled Douglas-fir from Douglas-fir beetle infestation. The study was well replicated, evaluated four dosages of MCH, was intensively monitored, and yielded results that clearly demonstrated that MCH could protect felled trees from beetle infestation. I very much enjoyed work on this project as it permitted my returning to bark beetle research, and it was very gratifying work as the results were so promising for management applications. Although I would have preferred to continue on this cooperative effort, that was not going to be the case as once again another insect had entered the picture and was about to re-allocate the efforts and direction of many western forest entomologists.

**The Douglas-fir Tussock Moth (mid 1970's):**

In 1972 through 1977, one of the largest Douglas-fir tussock moth epidemics in recorded history occurred in western North America. Hundreds of thousands of acres were defoliated with the majority of the outbreak occurring in northeastern Oregon, southeastern Washington, and northern Idaho. Other areas of western North America were also affected, including interior British Columbia, although the years of outbreak activity varied somewhat among western sub-regions. Defoliation by the tussock moth was highly visible, and during the period of the outbreak, coincided in some cases with catastrophic wild fires. Consequently, the public was very much aware of "the moth", as the timber industry was screaming for control measures, politicians were beating drums on their perceptions of what needed to be done, and the news media was having a field day calling for measures to stop the moths "march to the sea". In such a scenario, research administrators saw a ripe opportunity to secure additional

funding. And thus was the USDA Combined Forest Pest Research and Development Program funded in 1974. The CFPP was designed to be a national, short-term program to reduce damage being caused by the tussock moth, gypsy moth, and southern pine beetle. Each of these respective insect programs was soon labeled as one of the “big bug” programs.

Many, perhaps a majority, of western forest entomologists were soon mobilized to conduct research in support of the Douglas-fir Tussock Moth Program. At the Corvallis Forestry Sciences Laboratory, all but two of the resident forest entomologists were assigned to the tussock moth program. This was quite a cadre of scientists because in those days we had four research projects with a total of 17 entomologists or insect microbiologists on the staff. In addition to our staff at the Corvallis Lab., entomologists from other western research stations, FPM units, state agencies, universities, the British Columbia Forest Service, and the Canadian Forest Service’s Pacific Forest Research Centre laboratory in Victoria, BC, were also involved. The outcome of the Tussock Moth Program was quite successful as it served to coordinate and synthesize ongoing research efforts that in many cases had been in progress for years. In Corvallis, for example, Hank Thompson, Mauro Martignoni, Milt Stelzer, John Neisses, and others had been developing a nuclear polyhedrosis virus as a microbial pesticide for tussock moth for over 10-years; Boyd Wickman, Dick Mason, Torgie Torgersen, Bob Campbell, Roy Beckwith, and others had been researching the population ecology of the insect for years, Bohdan Maksymiuk, George Markin, and others had been developing formulations and spray technologies for both microbial and traditional pesticides for years; and, in my own case, I had been working with cooperators at the Oregon Graduate Center in an effort to identify the sex pheromone for approximately a year prior to the formal establishment of the Tussock Moth Program.

The tussock moth pheromone was identified in 1975 as a 21-carbon monounsaturated ketone, a unique compound among insect pheromones that had been identified up to that time. Doyle Daves and colleagues at the Oregon Graduate Center’s Department of Chemistry were outstanding in their research efforts to both identify and then synthesize this pheromone. A di-unsaturated compound that also appeared in our pheromone extracts was another suspect as a possible second pheromone component. Our efforts to chemically identify and validate the activity of a second compound, however, were unsuccessful. It wasn’t until over 20-years later that Gerhard Gries and colleagues successfully identified an active di-unsaturated ketone component of the tussock moth pheromone.

In 1976, shortly after the identification and synthesis of the principal pheromone component, we were asked to develop a pheromone-based trapping system to provide early warning against future tussock moth outbreaks. Existing monitoring methods were either too labor intensive to cover the host area adequately, or in the case of aerial surveys, provided information on outbreaks only after they were underway and it was too late for appropriate management planning and response. After two seasons of research to develop a prototype trapping system,

we implemented an early warning trapping program in the late 1970's. This was accomplished only because of the assistance from cooperators representing multiple agencies. Among others, these included John Wenz, USFS, San Francisco and later, Sonora, CA, Leon Pettinger, USFS, Portland, OR, Ralph Thier and Julie Weatherby, USFS, Boise, ID, Ladd Livingston and David Beckman, ID Dept. of Lands, David Overhulser, OR Dept. of Forestry, Rick Johnsey, Bob Backman, and Dave McComb, WA Dept. of Natural Resources, and Steve Kohler, Montana Dept. of Natural Resources. Other key cooperators that assisted in later years include Lonne Sower, USFS, Corvallis, Don Owen, Jess Rios, and Frank Spandler, CA Dept of Forestry, Dan Marlatt , Bur. of Land Management, Karen Ripley, WA Dept. of Natural Resources, Phil Mocettini, USFS, Boise, ID, Iral Ragenovich and Kathy Sheehan, USFS, Portland, OR, and Jill Wilson and Carol Randall, Coeur d'Alene, ID.

An average of over 700 trapping locations have been maintained each year since 1979, with the most intensive trapping programs taking place in Oregon, Washington, Idaho, and California. A recent publication that describes the results of 10 case studies of outbreaks where trapping programs were in place, validated that the system is effective in providing 1-3 years warning of an impending outbreak, so long as traps are placed appropriately and follow-up sampling is performed once trap captures have reached key thresholds. I am especially grateful to co-author Kathy Sheehan, USFS, Portland, OR, for her fresh perspective, expertise, and considerable patience with her co-authors, all of which greatly facilitated completion of that publication. I am also very appreciative of the efforts of Iral Ragenovich, USFS, Portland, for her efforts in attending to the continuation of the early warning trapping and certain other pheromone-based applications for the tussock moth.

A very significant effect of the Tussock Moth Program was to provide funding for new positions. In 1976 Lonne Sower transferred to our pheromone research group at the Corvallis Laboratory from the USDA-Agric. Res. Lab. In Gainesville, FL. Lonne had considerable experience with pheromones of agricultural and stored products insects, and his expertise was a welcome addition to our research team. His research on Douglas-fir tussock moth greatly advanced development of the pheromone, and particularly for its potential for controlling populations by the mating disruption technique.

No discussion of tussock moth pheromone research would be complete without reference to related human interest stories. The principal component of the tussock moth pheromone, Z-6-heneicosen-11-one, is far less volatile than most pheromones, probably because of its long chain length. This no doubt is the explanation as to why clothing, pets, and other objects that have been contaminated by contact with the compound can remain attractive to male moths for a very long time. Thus the stories of entomologists being swarmed by rusty tussock moths (a related species commonly found in and around populated areas) in their yards, at football games, and the like. Similar stories abound for individuals working with gypsy moth pheromone being accosted by gypsy moth males in the eastern part of the US. I recall a field trip in interior BC hosted by

Roy Shepherd in about 1977 when we toured numerous spray test plots that had been treated with various pesticides. One treatment, possibly dimilin, was acclaimed as being especially effective in controlling the larval population. As we stepped out of the vans and started into the plot, however, we were soon greeted by dozens of tussock moth males zeroing in on yours truly, no doubt due to my being contaminated by the pheromone. Later that same evening we were relaxing in a park next to a river, in Kamloops, BC as I recall. I remember vividly that the surrounding vegetation was predominantly grassland with a few shrubs, and very few trees. In fact, there were no host trees evident as far as the eye could see in any direction. And yet, sure enough, across the river came a couple of very determined tussock moth males fluttering toward me, obviously following a pheromone trail. What is most unnerving to me about this phenomenon is that it still continues, even though I no longer handle the pheromone!

**Western Pine Shoot Borer (1970's and 80's):**

In the late 1970's, our group was approached by the Weyerhaeuser Company to work on the identification and development of the sex pheromone of the western pine shoot borer, *Eucosma sonomana.* This was of great interest to me because if ever an insect's biology were vulnerable to its population being controlled by a pheromone-based method, it would be this insect. Why! Because even where it is causing economic impacts, it is present in comparatively low densities, and it is therefore especially dependent on its chemical communication system for males to locate females to ensure that reproduction occurs. Thus, a pheromone-based system designed to interrupt male to female communication behavior should have an excellent potential for suppression of populations. Principal cooperators in the western pine shoot borer work included Lonne Sower and Charles Sartwell, USFS, Corvallis, Tom Koerber, USFS, Berkeley, Steve Cade and Dave Overhulser, Weyerhaeuser Co., Klamath Falls, OR, Jed Dewey, Missoula, Montana, Roger Kitterman of what was at that time Albany International Inc., Phoenix, AZ, and more recently, Philipp Kirsch and Darek Czokajlo of IPM Technologies, Portland.

We made excellent progress both in identification of the pheromone and in the initial steps needed to develop formulations for both ground and aerial applications of mating disruption treatments for ponderosa pine plantations. Our results were especially convincing as the disruption treatments resulted in damage reduction. Dave Overhulser was a key element in our team effort on this research. Dave cooperated on all our field efforts and was the lead scientist on one of the major field experiments. Two pheromone technology companies registered commercial formulations for shoot borer control in the early 1980's; however their return on investment did not meet profit expectations and their commercial registrations were allowed to lapse. More recently, interest in the mating disruption technique for control of this insect has been revitalized by a cooperative effort involving Nancy Gillette of the USFS PSW Research Station, scientists and staff from Hercon Inc., and foresters from private timber companies. Additionally, Darek Czokajlo and Philipp Kirsch of IPM

Technologies, Portland, OR, have successfully tested and registered their "attract and kill" formulation for commercial application to control the shoot borer. The IPM Technologies approach relies on droplets of a combined pheromone and pesticide formulation distributed over a plantation. This method has also been effective in reducing damage, and at this writing is attracting the interest of several timber companies for suppressing shoot borer impacts in their pine plantations.

The success of pheromone applications to control damage caused by western pine shoot borer stands as a classic example of successful pheromone-based insect control among all such efforts that have been tested, including those targeting numerous agricultural insect pests. I have no doubt that if the impact of the shoot borer was better understood and documented with comparative data, that greater interest would be forthcoming from land managers interested in growing ponderosa and Jeffrey pines in plantations. There is clearly a research opportunity for comparing growth on pine plantations where the insect has been somehow excluded or treated to prevent its impacts to tree growth, versus that occurring on similar plantations where insect activity has not been suppressed.

**Spruce Budworm and Others (1980's):**

A next logical step for pheromone identification work pointed to the western spruce budworm, *Choristoneura occidentalis*, and related *Choristoneura* species that feed on western conifers. Once again we worked in close cooperation with Doyle Daves of the Oregon Graduate Center, and a new member of his analytical team, Therese Cory. We were soon able to report successful chemical structure identifications of the sex pheromones for both the western spruce budworm and the Modoc budworm, *Choristoneura retiniana.* Field experiments using synthetic budworm pheromone formulations in mating disruption treatments were conducted for population suppression, and for development of population monitoring traps to predict defoliation. Study results were promising but for the most part inconclusive. It was about this time that Christine Niwa transferred from Missoula, Montana to join our Corvallis group. Chris participated in research on the budworm monitoring trap activities, eventually taking over the lead on that effort and advancing the concept and technique.

Chris was also the lead scientist in identifying the pheromone of the ponderosa pine tip moth, *Rhyacionia zozana.* Following the chemical structure identification, Chris conducted mating disruption tests that confirmed that the approach was effective for that species. One of the most notable findings from Chris's research was the validation that the pheromone treatments caused no adverse effects on two parasites of the tip moth.

It was in the late 1980's that I was privileged to work in western Montana with Pat Shea, USFS PSW Station, Davis, CA, and Mark McGregor, who had become a field representative for PheroTech Inc. working out of Missoula, Montana. We were establishing plots to evaluate the anti-aggregative effects of aerial treatments of verbenone against the mountain pine beetle, *Dendroctonus*

*ponderosae*. Most of you who knew Mark will recall how much he enjoyed practical jokes, and also that he was very fond of firearms. On more than one occasion I watched as, with a big grin, he fired a round from a large caliber handgun into the air. I believe the handgun was a 357 magnum. Certainly its report was very loud, and, of course, Mark waited until Pat's attention was elsewhere when he touched it off. Pat's response was predictable, and the clear mountain air of western Montana would suddenly turn Technicolor! Mark's grin would just get wider, and you just knew he was already planning a repeat performance somewhere down the road. Those were memorable times, and we did complete a successful aerial treatment, although we would have preferred more conclusive results in terms of verbenone's suppressive effect on beetle behavior.

**Re-emergence of the Douglas-fir Beetle (1990's):**

The 1990's saw the USFS, PNW Research Station somewhat in turmoil. This was precipitated by the 1989 arrival of a new Station Director with an agenda to use the PNW Station as a testing ground for changing the U.S. Forest Service research organization. Over the next few years two of our field laboratories were closed, and the organizational structure of assistant Station Directors and Project Leaders was done away with in favor of Program Managers with responsibilities for research direction at multiple locations.

Within this scenario of organizational change, I was assigned to be the Acting Program Manager for Forest Health and Protection, and responsible for entomology and pathology research plus a few ancillary projects at three laboratory locations in Alaska, one in Washington, and three in Oregon. Clearly this was a full-time management position that would leave no time to conduct personal research activities. Interestingly enough, it was within this framework of events that I saw the opportunity to get back into bark beetle research. First of all, my research management assignment was to be temporary, and I envisioned a return to hands-on research within a year; secondly, our team's continuing work on lepidopteran pheromone development was in the capable hands of Lonne Sower, Charlie Sartwell, and Chris Niwa; and, thirdly, one Darrell Ross had recently been hired as a member of the Forestry Sciences Department Faculty at Oregon State University.

The opportunity to involve Darrell in pheromone research was evident, and I was fortunately able to scrape together a sufficient amount of funding for a cooperative project to immerse him in the fun and mystique of pheromone research on the Douglas-fir beetle. Darrell had limited experience in this line of research prior to 1992; however, as you all know, he is highly enthusiastic, and an exceptionally capable entomologist. You also know the rest of the story, because after a very short time Darrell became an expert on Douglas-fir beetle biology and ecology, and a pheromone applications specialist in his own right.

Teaming up with Darrell on cooperative Douglas-fir beetle research was especially fortuitous for me, as it turned out that my so-called temporary USFS

assignment in management and administration was to continue until 1997. Consequently, I have often thought that my limited time working on our cooperative projects was a great help in maintaining my sanity during a difficult period of transition. In any case, I thoroughly enjoyed our opportunity to work together, and somewhat later the expanded studies on Douglas-fir beetle in Idaho and Montana that included cooperation with Carol Randall, USFS, Coeur d' Alène, ID, and Ken Gibson, USFS, Missoula, MT. Additionally, we enjoyed memorable times working with Steve Munson and others in studies to evaluate MCH and aggregation pheromone components for spruce beetle, *Dendroctonus rufipennis*, in Utah.

We enjoyed a number of research successes working with the Douglas-fir beetle, primarily due to Darrell's efforts. The use of the anti-aggregation pheromone, MCH, was unequivocally demonstrated to be capable of protecting live trees from beetle attack. Perhaps most significant were the research results with high-strength aggregation pheromone lures that demonstrated the potential for wide-area treatments to influence where tree mortality takes place on the landscape. This concept still calls for additional research, but I believe such an effort could be highly rewarding. I have to attribute this viewpoint to concepts learned as a result of the PNW Station reorganization. Influences of that reorganization focused greater interest and awareness on area-wide management approaches, as for example, stream drainages, sub-watersheds, and the like. Such a viewpoint makes good sense, but raises significant research challenges, as it is a complex issue to determine or predict where a bark beetle population might disperse over large landscapes.

Some additional bark beetle work involved program management activities in Alaska, and cooperation with Jerry Boughton and Ed Holsten, USFS, Anchorage, and Skeeter Werner, USFS (retired), Fairbanks (at the time). There had been an immense spruce beetle outbreak in the early 1990's with white spruce tree mortality spread over millions of acres. This occurrence set the stage for high fire risks, questions about wildlife habitat, site restoration, and a multitude of other related resource issues. We worked together in an attempt to package an R&D proposal that would attract more federal funding for restoration treatments to the affected area. Although our efforts to attract more financial support were generally unsuccessful, I learned a great deal about the area and very much enjoyed working with the Alaskans and getting to know some of their many cooperators.

**What Now? (2000 +):**

It was early in the new millennium that I began to seriously consider retirement. A number of events came together at that time to cause me to consider that perhaps I had spent enough of my lifetime in the office and chasing after bugs. Eventually I followed through with that consideration and retired on January 3rd of 2003.

Since 2000, both before and after retirement, my entomological career has primarily consisted of completing studies and manuscripts. Most gratifying to me during this period was the successful completion, and publication, of the 1979-2001 results of the operational Douglas-fir tussock moth trapping program for predicting outbreaks in the West. I realize that I mentioned this earlier in this presentation, but I am repeating myself as I feel very strongly about the assistance of both John Wenz and Kathy Sheehan in helping to complete this manuscript. Their efforts were outstanding, and essential for completion of the manuscript. The paper relates the results of numerous case studies of outbreaks and the related performance of the trapping for predicting those outbreaks.

**Would I Change Anything? (In doing it again):**

Were it possible to go back and change my career decisions, I doubt I would make very many. Certainly it has been a most rewarding career, and receiving the WFIWC Founders' Award makes it even more so. This will truly be a standout memory that I will treasure always. Also of great value to me is the knowledge that some of the research findings in which I had a role in development, are in operational use and playing a role in forest resource management. Of most significance to me, however, are the close associations with some of the people I have worked with over the years.

I have been truly fortunate and blessed with a very rewarding career that has been greatly enhanced by associations with many fine and talented people. In addition to the science progress that we made, we also had a lot of fun. Again, I am deeply honored and appreciative of receiving the Founders' Award. I thank all of you and offer my particular thanks for the thoughts and efforts of those who nominated me.