Ronald C. Larson: This is an interview with Noel Wygant made at Fort Collins, Colorado on March 25, 1979. This interview is part of a joint historical research project on the history of Western Forest Entomology conducted by the United State Department of Agriculture Forest Service and the Forest History Society of Santa Cruz, California. The interviewer is Ronald C. Larson. All ownership of this tape, recording, and copies thereof results in the public domain.

Good afternoon Mr. Wygant. I'd like to approach this interview biographically and a good starting place I think would be for you to tell me when and where you were born.

Noel Wygant: I was born April 18, 1908 in Roanoke, Indiana.

Larson: Could you tell me briefly something about your childhood in those years that led up to you going to college, perhaps emphasizing events that led you into a career in entomology and forestry?

Wygant: Well I was one of a family of seven. I grew up on a small farm near Roanoke. I was always interested in outdoor things and farming in particular but when I graduated from high school, I thought I wanted to be a business administrator. So, I enrolled at Indiana University in Business Administration. After one year I found that I wasn't interested in that type of work and in 1928 transferred to forestry at Purdue University.

Larson: Why did you decide to go to Purdue and take up forestry?

Wygant: Well, frankly, I wasn't doing too well scholastically in math and other subjects and I transferred to Purdue where I made excellent grades and became very much interested in all the subjects. J. J. Davis, professor of entomology, was an excellent teacher and through his influence I became interested in Forest Entomology. As a result I used my extra credits transferred from Indiana University to take subjects in entomology at Purdue. So, actually I have a B.S. degree in Forestry and enough credits in entomology to receive a B.S. degree in entomology.

Larson: During the time you were working on your B.S. degree, you had worked on some summer jobs. Could you explain those, what you were doing and how those added to your education?

Wygant: The summer of 1930 I was fortunate in receiving a summer job with the Portland, Oregon Forest Insect Laboratory under the direction of Paul Keen. I worked with Buckhorn who was the project leader on insect surveys in the pine forests around Klamath Falls, Oregon.

Larson: As these individuals names come up that you worked with, would you mind giving a brief biographical sketch of each person--now we have Keen and Buckhorn so far. Could you tell me something about them--Paul Keen?

Wygant: Well, Paul Keen, of course, was well established in the profession of Forest Entomology and was well known throughout the country. He was, at that time, embarking--actually well into the development of a tree classification system for susceptibility of Ponderosa Pine to attack by the Western Pine Beetle. Of course, everyone in Forest Entomology knows about Paul Keen and the great impact he has had on forest management and his great knowledge about the forest insect problems.

Buckhorn was an unusual individual.

Larson: What's his first name?

Wygant: Walter--Walter Buckhorn. We worked the pine country around Klamath Falls, Oregon. I remember we worked five and a half days a week. Saturday

he reserved to go to town in Klamath Falls to buy groceries for the week. We had fresh meat for two or three days out of the week and then we had canned goods for the remainder. We tented or lived under the stars. So for an Indiana farm boy, it was quite an experience. The influence of Paul Keen and Walter Buckhorn had a great impact on my decision to continue with Forest Entomology.

Larson: You were working under some of the best.

Wygant: Some of the best--right.

Larson: After you received your Bachelor of Science Degree you continued on in school.

Wygant: Yes. In 1932, we were in the middle of the big Depression and none of the forestry graduates from Purdue received jobs. Eric Stark, another fellow student at Purdue, and I were the only two to receive any sort of a job and that was in terms of a scholarship to the New York State College of Forestry at Syracuse, New York. There I worked under A. H. McAndrews who perhaps is not well known in the literature and science of Forest Entomology as some of the other Forest Entomologists. But, actually, he was the finest and best teacher in my whole career. I owe a great deal to his teachings.

Larson: How did you get your scholarship?

Wygant: It was based on a scholarship and recommendations of my employers and before graduating. I worked also the summer of 1931 at Ashville, North Carolina under R. A. St. George on studies of the Southern Pine Beetle. Those two summer employments assured me that Forest Entomology was something I wanted to pursue.

Larson: And you're already able to see the importance of such an area.

Wygant: That's right. These summer jobs are quite an influence on young people.

Larson: That was probably fifty percent of your education--your summer internship.

Wygant: That's correct. I was also able to meet many other people in Forest Entomology through that.

Larson: Did you go straight through in school in your Ph.D program?

Wygant: No, I took the course work over a period of three years--1932 to 1935 and completed all my course work during those three years. I acquired data for a Doctorate Theses while I was employed by the Bureau of Entomology and Plant Quarantine at Fort Collins, Colorado.

Larson: I see. We're jumping ahead a little bit--you got your Ph.D in 1940.

Wygant: Yes, I got my Ph.D in 1940, five years after I had worked in the field.

Larson: But it concerned work you were doing.

Wygant: That's right. The dissertation was on the effects of low temperatures on the Black Hills Beetle.

Larson: We'll get to that. I just want to go ahead and establish what time you finished your dissertation. So now let's go back to 1935 when you actually began work as an entomologist. You worked first rather extensively on a shelterbelt program Could you go into some detail explaining that.

Wygant: Yes. I was invited by Dr. James Beal to come to the laboratory, then located in Denver, Colorado. It was established there in 1935. My wife and I came through in a Model A Ford from Syracuse, New York to Denver, Colorado through the dust bowl in late May. Upon arriving at Denver we had hardly seen anything green and I wasn't sure that my assignment to work on insect affecting shelterbelts was for me but it turned out very well actually.

In the summer of 1935 the U.S. Forest Service established the Rocky Mountain Forest and Range Experiment Station on the campus of Colorado A & M College. Dr. Richard McArdle was director. He along with the Dean of the Forestry College, Dr. Morrel invited the members of the Forest Insect Laboratory, then in Denver, to move to the campus. So, the laboratory was moved to the campus of Colorado A & M College in late summer of 1935.

Larson: How is it that you came to be sent back to the dust bowl area?

Wygant: Well, my assignment was to work on the insects affecting shelterbelts. This was a major project developed by a number of foresters interested in trying to improve the climate of the great plains and stop some of the wind and dust. So the Bureau of Entomology and Plant Quarantine in which I was employed was given money to study the forest insects in the great plains. So nearly all of my field time, was in the states of Nebraska, South Dakota, and Oklahoma, and Kansas so I didn't get to see too much of the Rocky Mountains until later years. It was a particularly challenging assignment because so little was known about the insects affecting the shelterbelts and there was little information in the literature about them so we were starting pretty much from scratch. Prior to 1935 Lynn Baumhaufer a forest entomologist, working out of the Coeur D' alene, Idaho Forest Insect Laboratory, had spent several summers at Hasley, Nebraska on the Nebraska National Forest studying the Pine Tip Moths that were severely damaging the pine plantations. Each summer through 1939 was spent pretty much on insects affecting the new shelterbelts and some of the older tree plantations. Actually, many of the plantations were quite successful--some weren't.

Larson: What were the problems that were affecting the shelterbelts?

Wygant: Mainly lack of precipitation and weed control. The farmers were paid on a cooperative basis to cultivate and control the weeds. Some farmers did a better job than others. The main problem insects were some of the borers in Cottonwood and Ash and foliage feeders such as grasshoppers and other miscellaneous insects. The trees out there were growing under a great deal of stress and as a result many of the so called secondary insects or less aggressive insects killed many of the trees.

Larson: They used trees that were native to the area from the shelterbelt, is that correct?

Wygant: Yes, largely. There were a few exotic species used rather extensively such as Russion Olive and Caragana. They used the trees that were pretty well known to survive the climate.

Larson: But doesn't it also exasperate the problem in that there's already natural insect pests in the area?

Wygant: That's right. All these insect pests we're talking about were already present particularly in the trees along the stream bottoms and old plantations. There were no exotic species except for the Pine Tip Moths that I mentioned earlier. These two pests were brought into the plantations on pine stock. As a result they were a very damaging species prior to my arrival there. Prior to 1935, Lynn Baumhaufer introduced two species of parasites which became established and very effective for two or three years. For reasons unknown, their effectiveness declined after about three years. At the time, it was considered to be one of the most successful parasite introductions. But, it's one of those complicated things we don't yet understand.

Larson: Where did they bring the stock in from?

Wygant: There were two species of tip moths involved. One probably came from the southwest--New Mexico or Arizona. The other one is an eastern and southeastern species.

Larson: How successful was your work on the shelterbelt?

Wygant: We didn't get too far in the five summers in the development of control measures. Direct control with chemicals on that type of plantation was pretty much out of the question, so we had to rely mainly on good cultural methods and to maintain the plantations in the healthiest possible condition.

Larson: So, once these farmers were paid to take care of these areas if they improved their caretaking, their insect problem decreased.

Wygant: That's right.

Larson: During these years of 1935 to 1939, what type of work was being done back here at Fort Collins?

Wygant: At that time, Dr. James Beal, Lynn Baumhaufer, Dwight Hester, and Jack Whiteside were located at Fort Collins. Except for Baumhaufer and Beal who gave part of their time to problems in the great plains, much of the work was directed towards studies of the Black Hills Beetle and to technical assistance to the U.S. Forest Service and other forest land owners having insect problems. The principle problem at that time was the Black Hills Beetle. A few defoliators such as a Pandora Moth and the Great Basin Tent

Caterpillar were present but weren't causing extensive damage. Nearly all the effort was spent towards studies of the Black Hills Beetle.

Larson: Which is a continuing problem.

Wygant: Right and became much more severe in later years. At that time, there was direct control work going on against the Black Hills Beetle through the CCC Program administered by the U.S. Forest Service. During that period, the control method was to fall the unfested trees, deck the logs, and then burn the decks when conditions were right.

Larson: Can you tell me what effect the CCC had on entomological work?

Wygant: It had a great influence because the foresters had an opportunity to do some needed control work and also it helped to finance directly or indirectly some of the insect surveys. In turn it helped our research program.

Larson: It seems somehow that I understood that the CCC really gave a big shot in the arm to the Forest Service-- that the Forest Service really grewup at that time and they had to actually come to a whole new management system to handle the increase in personnel--that's when they had the same sort of impact on the Bureau of Entomology and Plant Quarantine.

Wygant: Yes, it did because in turn it meant more demand for the services of the forest entomologists to work with the foresters in developing some of these other campaigns.

Larson: In 1940 Jim Beal resigned, correct?

Wygant: Well, September 1939 actually.

Larson: September 1939.

Wygant: Yes.

Larson: Could you tell me then what changes took place at Fort Collins.

Wygant: Yes. Robert Furnis from the Portland, Oregon Forest Insect Laboratory moved to Fort Collins in the early part of the calendar year of 1940 and was the replacement for Jim Beal. At Fort Collins at that time was Don DeLeon who was an outstanding forest entomologist and who was transferred to

Fort Collins about 1938, as a replacement for Lynn Baumhaufer.

Larson: Where did Baumhaufer go?

Wygant: Baumhaufer transferred to Beltsville, Maryland, the headquarters office for the Division of Forest Insect Research.

Larson: 1940 appears to have been an exciting year in Fort Collins office.

Wygant: Yes, it was--

Larson: Beal had left and had gone to the University of North Carolina, correct?

Wygant: Duke University.

Larson: Duke University. Could you tell me what happened in terms of fiscal and other matters at Fort Collins in 1940.

Wygant: Well, the Bureau of Entomology and Plant Quarantine, which the Division of Forest and Insect Research was a part, administered the insect control programs for the U.S. Department of Agriculture including Dutch Elm disease control in the northeast and Gypsy Moth. A U.S. congressman, I believe it was in Connecticut, had some Elm trees removed from his property that were diseased and he didn't want them removed. At that time they were trying to rid the spread of the disease and as soon as a diseased tree was found, it had to be removed under Federal and State laws. This person became very upset with the fact that the federal bureaucrats had removed these trees and he set upon himself to see that Dutch Elm Disease would receive a drastic cut in appropriations. Unfortunately, he didn't succeed as he directed his energy in the wrong direction. He thought he was trying to curtail the funds for Dutch Elm disease control when in reality it was Forest Insect Research.

Larson: Who was this?

Wygant: I don't remember the name of the congressman but that was in the Spring of 1940. Lee Strong, who is the chief of the Bureau of Entomology and Plant Quarantine, told Dr. Craighead that he had to come up with cuts and where he would apply the cuts. Dr. Craighead applied the cut percentage-wise across all the stations but the pressure from

the west coast industries were so great against cutting the California and Portland stations that Strong was told that he couldn't cut those so heavily. At that time, Paul Keen at Portland, and particularly, John Miller, who was the laboratory leader at the Berkeley, California Forest Insect Laboratory, had some major projects underway on the susceptibility of Ponderosa Pine to attack by the Western Pine Beetle. It was an excellent project and program and it had a lot of industry and foresters' support so it was a valid claim. Craighead in turn was given an edict to cut out one station. Craighead and Strong said it would be the Fort Collins laboratory so the laboratory was closed effective July 1, 1940.

Larson: Why was the Fort Collins station picked?

Wygant: Largely because there was little support from the forest industries for the surveys and research work and because forestry and forest products wasn't as valuable and important in this region as it was in others. It was a decision that Craighead had to make but it had to be done. Dr. DeLeon and I were transferred to Berleley, California. We moved out there during the last of June in 1940 and Bob Furnis was an outstanding young forest entomologist and very influential in the development of the Forest Entomology Programs for the northwest.

Larson: Could you describe your association with and knowledge of Frank Craighead who really is an important man in the development of the science it seems.

Wygant: Yes, Dr. Craighead was and is the best informed person in forest entomology in the United States. He had a tremendous interest in young people and programs. He was an unusual individual who disliked administrative work. He had many very valuable publications to his name when he was employed by the Bureau of Entomology and Plant Quarantine in 1926.

Larson: So you think he had what would be considered a modern approach to the problems of forest insects--I mean in terms of an ecological approach where he viewed the whole problem as a part of a larger system?

Wygant: Definitely so. He was probably a number of years ahead of his time in the field of entomology in developing this area. At the same time, he

was interested in direct control and realized that under certain circumstances it was desirable. When DDT was first introduced as a control tool, he was the first of the federal entomologists to develop studies to determine the effects of DDT on beneficial insects and other animals. And while he's criticized for the use of DDT, he nonetheless was perhaps more concerned about the possible side effects of DDT than any one other person. He was interested in all aspects of forest insect control, including forest managment control. He was very well pleased with the approach that Keen and Miller were taking towards the control of the Western Pine Beetle.

Larson: Which was--what was their approach?

Wygant: Oh--through cultural methods or removal of the susceptible trees and gaining use of the wood and leaving a stand with more resistance.

Larson: To the selective cutting.

Wygant: To the selective cutting--that's right.

Larson: Okay, you were at Berkeley for two years.

Wygant: Yes, first I was working with Dr. Ken Salmon who was working on a--

Larson: that's spelled S-A-L-M-O-N, M-A-N?

Wygant: I'm not sure. I spelled it many times but I've forgotten. He was using a bit different approach than Paul Keen. There was quite alot of competition between the two individuals at that time but actually their objective was the same, that is to prevent losses by the Western Pine Beetle through selective cutting. They had different terminology and different methods of arriving at the same results.

Then the summer of 1941 I was working with Dr. Ralph Hall. Our field season started May 1941. My wife and I and family were living in a tent at Blacks Mountain Experimental Forest taking certain measurements on needle length and color and width of annual growth and other things on susceptible and supposedly resistant trees to see if there was a measurable difference in such factors that could be used in appraising or evaluating a stand of Ponderosa Pine as to its susceptibility.

Then in the Fall of 1941, I went on to surveys--

Larson: Let me interrupt you here. How did you go about testing this?

Wygant: Trees were selected as to their susceptibility by Jack Bongberg or others of the Berkeley station. There were experimental logging operations going on at the Blacks Mountain Experimental Forest. When those trees were felled, we could take our measurements in association with the logging project. Nothing conclusive was gained from that study.

Larson: So insect susceptibility is still in the realm of theory.

Wygant: Yes, theory, but that's all. It's been highly successful. They've not been able to pinpoint the real cause of susceptibility except decadence of individual trees. Paul Keen's system and also the risk rating system of the California station both received alot of use in those so called virgin stands. I don't know how much use is made of it today but I suspect considerable.

Larson: It's still one of the--

Wygant: It's a classic--

Larson: Reasons for selective cutting--

Wygant: That's right and it's a classic in the selective cutting.

Larson: You started to tell me what you did in the Fall of 1940 before I interrupted, so would you like to continue with that?

Wygant: Yes. Established earlier by the personnel of the Berkeley laboratory, were sections and half section plots of Ponderosa Pine stands that were surveyed annually to measure the loss or kill by the Western Pine Beetle and other insects. This was done for the purpose of measuring the loss and determine what classes these losses occured in. So we were busy from September through October making these measurements for that study.

Larson: In 1942, the Fort Collins station is reopened.

Wygant: Yes, it was reopened effective July 1, 1942. In 1940 and 1941 insect problems were developing

in some of the forest stands of U.S. Forest Service Regions 2 and 3. I was sent back to New Mexico to review or assess the Great Basin Tent Caterpillar problem in the Aspen stands. At that time, the Aspen stands, over thousands of acres, were being defoliated and much complaint in particular was raised by the fishermen, picnickers and others because of the vast number of caterpillars crawling here and there and clogging some of the smaller trout streams. Then, too, the Black Hills Beetle--

Larson: Before you go on, could you describe the Great Basin Tent Caterpillar, its life pattern and how it affected trees?

Wygant: Yes, it overwinters in the egg stage on the twigs and emerges in early Spring as tiny caterpillars. The larva feed in large numbers on the foliage and then pupate on the ground or twigs and various other places. The moths emerge in late summer and lay their eggs. At that time we noted a virus disease developing in some stands and that alot of caterpillars had been killed. The problem, economic-wise from a standpoint of forest values, was not very great but there was a demand for a solution to the problem.

Larson: What did you do to try to solve it? Did you hope that the virus would take hold or did you try some other method of direct control?

Wygant: Well it was considered to introduce some other species of parasites, ones that had been introduced from Europe for control of the Gypsy Moth. Some of the living individuals were released and so far as we know, they never became established or were not successful. A few years later in working with an insect pathologist, some tests were made on culture of the virus. I believe it was in the late fifties, some actual field tests were made. Again, it was a case of releasing a native virus against the insect. The theory at that time was to establish the disease at an earlier date. The plots set aside as having had no mortality of the larva from the virus disease, turned up the virus disease in great abundance. There were indications however, that there was a more rapid development of the disease in the unsprayed plots. But again, it's a case of trying to introduce or to multiply a native, natural control agent. In theory this hasn't worked out too well.

Larson: Did the Tent Caterpillar threaten to go into any sort of tree other than the Aspen?

Wygant: It would defoliate the Choke Cherry and other species of less importance but primarily it was the Aspen, and usually the final mortality of the trees was not too great because the outbreak usually subsided before the trees were badly weakened. In other words, the infestations would usually last three years and at that time the native natural control agents would bring it under control.

Larson: So in other words the problem was mostly one of esthetics.

Wygant: That's true--and recreation.

Larson: When Frank Craighead sent you back to Fort Collins, you were beside yourself, right?

Wygant: Yes.

Larson: How much of an area were you to cover?

Wygant: I was supposed to attend to all the insect problems in New Mexico, Arizona, Utah, Colorado, Wyoming and South Dakota plus the Great Plains. Of course most of my time for the next two years, and to a great extent later than that was spent in examining and evaluating the various infestations present at that time. This was during the war and the amount of control work wasn't great.

Larson: Why is that?

Wygant: There were other more important things at that time for use of the manpower. Many of the younger forest entomologists were drafted into the service.

Larson: So you have always been crisis oriented but now you were even more so--I mean something would have to be really bad for you to have to act upon it.

Wygant: That's correct. At that time we were developing ideas and thoughts for avenues of research that we would be able to go into and we had more people to assign to specific problems.

Larson: In 1943 before the war was over you did have a severe crisis in the form of the Engleman Spruce Beetle. Could you tell me where that took place

and how it was discovered and then get into the treatment and other discussion of it.

Wygant: The summer of 1943, the district ranger for the White River Plateau north of Glenwood Springs, Colorado on the White National Forest, reported a very heavy infestation of a bark beetle in the Engleman Spruce and would I please come over and look at it at the earliest opportunity. So I believe it was in Septemeber 1943 that he and I rode horseback over a large area and in particular one area that had been surveyed and sold for timber harvest. Practically every tree was either dead or currently infested. We took a long, five day trip on horseback through the flat tops and discovered that the infestation was present over more than five hundred thousand acres. After this trip through the flat tops with the district ranger, I reported immediately to Dr. Craighead about the situation. The bark beetle was identified as the Engleman Spruce Beetle. It was too late in the Fall to do any more field work so we mapped our program for further surveys in 1944. Studies of the biology of the beetle were also planned; and, in the Spring of 1944 we made a more extensive survey of the area and found what we indeed observed the Fall before was true throughout practically all the stands of the White River National Forest. Dr. Cal Massey, who had completed the requirements for the Ph.D degree in Forest Entomology at Duke University, was employed to study the biology of the beetle. He lived at the guard station on the White River National Forest where he was able to make the studies. At that time, the biology of the beetle was poorly known. No major outbreaks had developed in the past forty years or more. Massey discovered that the beetle indeed did have a two year cycle instead of the one year life cycle as reported by Dr. A. D. Hopkins. Also, George Struble from the Berkeley, California laboratory was assigned to study the biology of the beetle on the Grand Mesa National Forest where another center of outbreak was located. George Struble discovered that most of the adult beetles overwinters the second year beneath the bark at the base of the trees. This was an unusual habit for tree killing bark beetles. Some of the Ips Bark Beetles are known to hibernate as such, but this is a first occurence for dendroctonus beetles. This habit has an important bearing on the ability of this beetle to survive the cold winters of the subalpine zone.

Larson: They're insulated by snow.

Wygant: Yes, they're insulated by snow. The beetles themselves can't survive temperatures below 10 degrees. The temperature, of course, never reaches that cold beneath the snow.

Larson: Tell about some of your control methods and the experiments that were undertaken to control the Engleman Spruce Beetle. I know one that I'm interested in is your use of trap treés.

Wygant: Yes, our interest in use of trap trees. It's a very, very old method that was used in Europe against some of the Ips Beetles and other bark beetles. We observed that the outbreak on the White River National Forest and subsequent outbreaks came from windthrown trees. The White River National Forest outbreak developed from a windthrow in June 1939. Of course the foresters weren't aware of the fact that the beetle would develop in windthrown trees; in fact, this knowledge wasn't available until our observations were made. We observed that if there were felled logs or windthrown trees available, the beetles would go into these trees in preference to standing trees; hence, our interest in the trap trees.

Larson: How would you set up a trap tree?

Wygant: Well, a trap tree is any green tree that is felled just prior to the flight of the beetle. The beetle flies in June and early July--that's the flight period. The trees must be felled the Fall before or early Spring. They should be along roads where accessible and can be hauled to the mill where the slabs can be treated or burned. Another discovery--this was by Dave McComb, who was then a summer employee working on his masters degree in Forest Entomology and Roy Nagel, who was transferred to the Fort Collins laboratory from Beltsville, Maryland to work on this project. They found that the number of attacks per square foot on windthrown trees or felled trees were approximately ten times as many as those on standing trees; hence, it looked as though trap trees would absorb the population of up to ten standing trees. It offered a real prospect and I personally think it will have greater use in the future when there are more roads available for the use of this method. Problems have resulted in some cases where trap trees were felled ahead of the building of roads and

by the time the roads are built and the timber sale consumated, the beetles had already flown from the trap trees. As a result, the trap tree method fell in ill repute largely because of the inability to get the trees out of the woods in time to capture the beetles.

Larson: So they could actually increase the problem by giving them a place to breed?

Wygant: That's correct and in some cases this actually happened.

Larson: What other types of control work did you do?

Wygant: Well, the use of orthodichlorobenzene in fuel oil for bark beetle control was developed by the Forest Insect Laboratory at Coeur D'alene, Idaho. So immediately the Fort Collins laboratory embarked upon some tests to see whether it was equally effective against the Engleman Spruce Beetle. It was used during the 1949 and 1950 control campaigns. It penetrated the bark very well and was successful in killing the beetles. Also, and at the same time, we developed the standing methods of control--spray the tree standing. With the proper equipment the spray would reach up to about thirty-five feet but that was sometimes not adequate to reach the height of the infestations.

Ethylene dibromide, a fumigant insecticide that was used largely for fumigation of various agricultural products, was considered to be a likely prospect of a chemical for use in bark beetle control. Bob Chism from the Bureau of Entomology and Plant Quarantine at Morristown, New Jersey, was assigned to the laboratory to work with Cal Massey in developing a water emulsion spray. The problem with use of the fuel oil solutions of orthodichlorobenzene and of ethylene dibromide was the transport of large quantities of fuel oil. The emulsions of ethylene dibromide proved to be effective and cheaper than orthodichlorobenzene. It was used in much of the campaigns in 1950 and 1951 against both the Engleman Spruce Beetle and the Black Hills Beetle.

Larson: Couln't various methods be combined so that you could use trap trees and then you could come in and spray them or apply a bark penetrating solution to kill the beetles.

Wygant: Yes, the U.S. Forest Service used this in some cases where drawing in a large number of beetles into individual trees was cheaper than to spray eight or ten standing trees. The trap trees can be used in combination with the chemical control method.

Larson: In 1946 an epidemic of Spruce Bud Worms was noticed. Would you go into a similar discussion as we just went through on the Engleman Spruce Bark Beetle.

Wygant: Yes, in southern Colorado in particular and in Rocky Mountain National Park there were outbreaks of the Western Spruce Bud Worm and at the time DDT was just becoming available as an insecticide. The U.S. Forest Service requested that some experimental test-spraying be done to see what could be accomplished. One of the earliest tests of spraying was ground spraying in Rocky Mountain National Park with DDT. Leslie Orr, from the Beltsville laboratory, was assigned here to do that study. The ground spraying with a high pressure sprayer gave excellent results. Then the following year a small aerial spray program was done but the results of the aerial spraying was inconclusive. The spray was put on very efficiently and properly but just within a few days after the spray was put on--and this was mid-June--an unprecedented late freeze killed all the new growth on the Douglas Fir tips. As a result, many of the caterpillars starved to death on the sprayed as well as on the unsprayed plots. So we couldn't measure very well the effectiveness of the DDT.

Larson: Doesn't DDT usually have an immediate effect though?

Wygant: Yes, it has an immediate effect but the measurement at that time was the measurement of the amount of foliage that was saved by spraying versus non-spraying. Since the new growth was killed by the frost, we had no really good method of measuring the effectiveness.

Larson: Where did you apply the spray?

Wygant: This was on private land near Estes Park, Colorado near Mt. Olympus. As I recall, thirty acres were sprayed. One interesting incident here was the report of the effects of DDT on other animals. When you do aerial spraying, you get up about four o'clock in the morning and be out there with your plane loaded to take off at daybreak. Well, the

Denver Post reporter was on hand to make an account of it and he said, "Well, boys, I don't get up at four o'clock so I'll see you later in the day." Well, he wrote his story the night before and sent it in. It turned out the next morning that the wind was too high so we didn't spray. We weren't able to spray for three more days. It so happened the northern migration of the Cedar Wax Wing was taking place in the city of Loveland. At the same time there was a severe ice and snow storm and there was a number of Cedar Wax Wings dead. Immediately an article came out in the Denver Post about the effects of DDT spraying on the bird life and this happened at Loveland thirty miles away and we hadn't even applied the DDT.

Larson: Well, I guess that was a sign of things to come. When you were given the DDT to use, what sort of instructions were you given and what did you really know about the DDT?

Wygant: Not too much was known and Dr. Craighead and others of the Beltsville laboratory kept us well informed of all available methods of application and so forth. In these very first applications, Dr. Craighead saw to it that the Bureau of Entomology and Plant Quarantine and the U.S. Forect Service alotted funds to the Fish and Wildlife Service to make a survey of the fauna--particularly the mamals, birds and others in an area before it was sprayed. A team of at least two people were assigned to each spray job to measure the annual populations, including insects, before and after the spray.

Larson: Beneficial as well as noxious insects?

Wygant: Yes--make samplings of the populations to see what insects and animals it might affect. Dr. Craighead and others in the Bureau of Entomology and Plant Quarantine foresaw the possible undesirable effects of DDT. It wasn't a matter of indiscriminate use of the DDT.

Larson: It was still in the experimental period and it seems like it was under rather controlled conditions.

Wygant: Yes, it was. We, in forest entomology, were very well concerned before the ecologists and other people became concerned.

Larson: Did you find that there was any effect of DDT when you were monitoring this and was this also done in 1946 when you first did the spraying?

Wygant: Through several experimental spray jobs including others against the Pine Tip Moth and the Black Hills Beetle; this approach was used in every case. Of course the insects flying in the area came back in subsequent years. The spraying in such small areas killed many insects but they moved back the following year from the surrounding areas. It wasn't really an involved test over a large area.

Larson: What was the damage to the Spruce from the Spruce Bud Worm at that time?

Wygant: The Spruce Bud Worm feeds primarily on the new growth. Overwinters in hibernaculae beneath the bark and emerges in the Spring before the buds break. For the first or second instar, they mine the old needles for food and by the time the second or third instar is reached, the buds are opening on the Douglas Fir and the White Fir. Then the later instars feed on the open buds and foliage. It's primarily a defoliation process and it takes several years for the feeding to actually kill trees. In other words, the tree becomes a bit weaker each year and sends out less foliage. Many outbreaks subside before the trees become severely weakened. The mortality in some areas has been not too great while in other areas the outbreaks have persisted for more than three or four years and there has been some mortality of the Douglas Fir and White Fir.

Larson: Did you make any surveys to determine loss?

Wygant: Yes, this was largely done by aerial surveys. Aerial observers mapped the areas to make a measurement of the loss of foliage. These outbreaks appear to move from one place to another but actually natural factors tend to kill most of the population of the bud worms before damage becomes severe.

Larson: Going on with the aerial surveys, could you tell me about some of the individuals who were involved in this and something of the technology that was used?

Wygant: Tom Terrill from the Coeur D'alene laboratory transferred to Fort Collins to help out with the Engleman Spruce Beetle survery. Tom had alot of experience with surveys of the Mountain Pine Beetle in Idaho and Montana and was the ideal person to spearhead the surveys of the Engleman Spruce Beetle. This meant the sampling on the ground of the infested trees as well as aerial observation and systematic aerial surveys.

Later, Amel Landgraf and Fred Knight and seasonal employees helped us on the aerial surveys. Getting back to the Engleman Spruce Beetle surveys, aerial surveys are not too successful in early detection of outbreaks because the trees infested by the beetle in July and August do not fade until the following Spring. Even then the needles tend to drop off before they become the characteristically straw yellow color that the pine trees reach when infested with bark beetle. So we had to rely pretty largely on the ground surveys. Tom Terrill and his crews, during the period from 1944 through 1951, were responsible for coming up with both the detection of new outbreaks and measuring the mortality of Spruce in the old outbreaks. By 1949, the mortality from the beetle had reached more than three billion board feet on the White River National Forest. It was by that time, in 1949, that most of the larger trees were killed on the White River Plateau. The opportunity was seen to possibly prevent the flight of the beetles out of the area into adjacent national forests. In 1949, the principle efforts of surveys of the Engleman Spruce Beetle was made in the surrounding forests to determine where the beetles might have flown. There are several interesting observations that were made in 1949 by people living in the area. The small airport at Eagle, Colorado was closed for two days because the beetles in June were so abundant that they were annoying all the people. The other was at Trappers Lake, which is a large natural lake in the northeast part of the White River Plateau. The beetles were drowned in this lake to the extent that on the leeward side, beetles were reported by Lee Yeager to be a foot deep and eight to ten feet wide for a distance of a mile. That will give you some idea of the large numbers of beetles that were looking for a food source. This was in 1949.

Larson: Well, how was that to do with your return back?

Wygant: After many conferences and review of the survey findings with the Bureau of Entomology people and the U.S. Forest Service, they decided that in order to save the adjacent Spruce stands and the Engleman Spruce stands throughout the state something should be considered and something should be tried. In the Fall of 1949, a test project was made with orthodichlorobenzene in fuel oil on a couple thousand trees on the Holy Cross National Forest where the outbreak had spread from the flight that summer. From aerial mapping it was determined that Engleman Spruce was in jeopardy

in the Holy Cross National and the Routt National Forests. After review of all the surveys and research results, the control project was proposed for the season of 1950.

Larson: Was this a decision that was easily reached, or was there debate involved of what the action should be?

Wygant: There was very much debate. There were those, of course, who believed that a direct 'control project would not accomplish the desired end nor phsically and economically be achieved. There were others who believed that something should be done or tried. Many conferences were held by different people and it was decided then that a project would be undertaken in 1950. We had two congressional investigations. Some congressmen actually visited the area and flew over the area to see the kill of the Engleman Spruce and also two members of the congressional finance committee reviewed the whole proposal. The project would cost about two million dollars and that was alot of money in 1949.

Larson: That was alot of money especially for the Bureau of Entomology.

Wygant: Correct. The industry people on the west coast were pretty much opposed to it. They objected to spending large sums of money on an area of timber of unknown value. At the same time, the Forest Service was trying all avenues for salvage of the dead Spruce. Some roads were built but the cost of operating and removing that timber--there was quite alot removed for pulpwood--but the cost of the removal and the short logging season made it really difficult financially for a large scale project. Also the building of roads is very expensive. A logging control method was pretty much out because it would take about two years to build a road and by that time the outbreak would be too far along--an opportunity for salvage but not salvage-control.

Larson: And salvage is absolutely necessary really to protect the forest. Otherwise, you would have a whole bunch of trees there that have essentially the same effect of trap trees. Could you tell me who some of those people were who were involved in the controversy on whether to practice direct control or not?

Wygant: Yes. I think Bob Furnis and Paul Keen and John Miller were pretty much opposed to this method because direct control had been tried against the Western Pine Beetle many times and against the Mountain Pine Beetle too. The outcome didn't warrant the expenditure so their philosophy carried through to the proposed Spruce Beetle control. On the other extreme were some of the naturalists that said control must be achieved at any cost and that cost was a small matter. The entomologists and foresters were caught in between and had to reach a decision which way to go. It was obvious that much of the Engleman Spruce type in Colorado--which is and was overmature and highly susceptible could have been lost unless measures were taken. Fortunately, we had some help from nature later that precluded the determination as to whether the direct control was effective.

Larson: Could you tell me about that? What finally did cause this epidemic to slow down?

Wygant: Well, in 1950 about a million trees, I believe, were treated with orthodichlorobenzene or ethylene dibromide.

Larson: This was done on the money granted to you?

Wygant: No, the U.S. Forest Service--the entomologists were in the Bureau of Entomology and Plant Quarantine--we were technical advisors and would make the surveys and work with the Forest Service on appraising the results. There were a number of large camps set up on the White River, Routt and Holy Cross National Forests for the Spring project. The program itself was carried out very efficiently by the U.S. Forest Service. The surveys made in the Fall of 1950, indicated that the outbreak was by no means under control and an equally large or larger project would be necessary in 1951. On February 1, 1951, an all time low temperature was recorded by all the mountain stations. For example, at Eagle, Colorado a temperature of minus fifty-nine degrees below zero was recorded. At Fort Collins a temperature of forty-one degrees below was recorded. This was hailed as a Godsend and survey crews were sent out on snow cats and snowshoes and skis to collect samples to see what these low temperatures had done. In the meantime, we had made laboratory tests of the cold hardiness of the Spruce Beetle and found that it took about a minus thirty-two degrees below zero to kill the larva beneath the bark and that about ten or twelve

degrees below zero kill the adults. We had some previous knowledge that the beetle might be affected. Samples from infested trees, were taken to the laboratory where mortality counts were made. It was learned before the snow had melted and before the control season had arrived that the mortality was indeed very high. As I told you earlier, a large percentage of the beetles in its second year, hibernate beneath the snowline so measurements of that population indicate that survival was very high. All insects above the snowline were killed.

Larson: So, ninety percent of the population--

Wygant: We estimated that ninety percent or better of the whole population was killed by the freeze. This enhanced the effect of the woodpeckers which are the most important preditors of the Engleman Spruce Beetle. There are three species. The most important one is the Northern Three Toed, the Hairy, and to a lesser extent, the Downey Woodpeckers. They congregate in infested areas--as many as thirty or forty birds per acre. They aggregated where there was a good food supply.

Larson: But of course their population increased because there had been--

Wygant: Yes, they had increased to a very high level because there was an abundance of food supply and with the decrease in the food supply and with the much reduced beetle flight from the freeze plus the chemical control the year before meant the woodpeckers had to search more diffigently to find a food source. In turn they did an excellent job on the population that went into the trees in the summer of 1951. Here is an interesting thing about adaptation of insects to their environment--the hibernation habit in the bark at the base of the tree is one of adaptation. I think that the felled tree or the blowdown is another. The outbreak on the White River Plateau actually developed from blowdown in June 1939. These beetles were protected from low temperatures by the snow cover during the winter and to a great degree from predation by the woodpeckers because they were beneath the snow. The woodpeckers, to remain in an area require a yearround food source. There would be a period of two or three months in the winter when the beetles, in these blowndown trees, would be protected from the woodpeckers.

Larson: Did you also at this time use any direct control methods to try and eliminate any surviving beetles?

Wygant: Yes, the program in 1951 was directed towards spraying the bases of these trees that contained the hibernating beetles and also in the portion of the trees protected by the snow. It meant that only the lower parts of the stems needed to be sprayed. It was very delightful to see that the woodpeckers had done a very good job of controlling the population in the other parts of the stems. In 1951 this occurred and it carried through to 1952. I might also mention that the forest entomologists and the foresters were very concerned about the effects of orthodichlorobenzene and ethylene dibromide on the woodpecker population. There were some people from the Fish and Wildlife Service assigned to the program to observe the possible effects. This was a difficult thing to observe but as soon as the larva were killed by the insecticide, the woodpeckers were feeding on unsprayed trees. The chemical control too, worked in conjunction with the woodpeckers by forcing the woodpeckers into areas where it was literally impossible to get spray people and equipment in, to treat the trees.

Larson: So you didn't see any harmful effects on the woodpeckers?

Wygant: No, there were no harmful effect observed..

Larson: Long-term effects couldn't be measured.

Wygant: Long-term effects couldn't be measured at that time.

Larson: So I guess nature really had the largest impact on the largest impact on the woodpeckers once the beetles died off and, of course, they would have had to have died off too.

Wygant: Yes. The woodpeckers are by far the most important preditors. Some projects were carried out with Dr. Paul Baldwin to determine the feeding habits. Dr. Massey, who was working on the biology of the beetle at that time, took a certain number of woodpeckers during the summer of 1945 and found that the food in the stomachs of the woodpeckers approached about one hundred percent larva and adults of the Spruce Beetle. The studies by Dr. Baldwin showed that the woodpeckers do move around a great deal in the winter time in groups to where there is a food supply. It's believed that when small outbreaks of the Engleman Spruce Beetle

develop--that is a few hundred acres--the woodpeckers aggregate in such areas and tend to take upwards of ninety percent of the population of the beetle. Outbreaks occur only when a wide spread blowdown such as that in 1939 where there is a vast number of beetles produced. The woodpeckers population development lags behind that of the Spruce Beetle. But when control measures or a freeze slows up the population of the Spruce Beetle, the woodpeckers become truly effective.

Larson: But normally the woodpecker keeps the insects out--

Wygant: Normally the woodpeckers will keep the Spruce Beetle under control.

Larson: We left off on the first tape discussing the record freeze of 1935 and its effect on the Engleman Spruce Beetle. Did this freeze affect any other insect infestations?

Wygant: Yes. The freeze was widespread throughout the Rocky Mountains. It had a pronounced effect on the Black Hills Beetle, now known as the Mountain Pine Beetle, in the Black Hills of South Dakota and in the Front Range of Colorado. Our field surveys showed that approximately ninety percent of the population was killed. The concern and need of direct control measures was alleviated for several years until the population had a chance to build up again. By the mid to late fifties, the population had built up to epidemic proportion, both in the Black Hills and on the Front Range. At that time, there was considerable opposition to direct control by other forest entomologists, in particular, Paul Keen from Berkeley, California and Bob Furnis in Portland, Oregon because they had found direct control methods were not effective against the bark beetle outbreaks in their regions. Also, we were working pretty much under the success of the use of selective cutting in the Ponderosa Pine for management of the Western Pine Beetle problems. We were often questioned as to why such an approach would be equally effective against the Mountain Pine Beetle. I've forgotten the exact year but it was in the late fifties that Paul Keen favored us by coming to the area and spending a week or more with Dr. Bill Wilford and me, looking at some of the infested areas in the Black Hills and on the Front Range. This outbreak was in young stands of Ponderosa Pines in the northern part of the Black Hills. The trees were largely sixty to eighty years old and in what is now known to be overstocked stands. We looked at a number of

the stands and Paul Keen agreed that we were faced with a beetle with habits different from the Western Pine Beetle. What worked against the Western Pine Beetle wouldn't necessarily be effective against the Mountain Pine Beetle.

Larson: Excuse me--the Mountain Pine Beetle is the most aggressive probably of all the pests, isn't it?

Wygant: Yes, it's truly a tree killer and it doesn't depend upon a weakened or decadent tree for attack. The difference between an attacked and an unattacked tree superficially is little if any different. We have followed that study with one by Dr. Ed Molgren, who was a graduate student working under Dr. Sam Graham at the University of Michigan. He measured the growth rate and evaluated the crown conditions of the infested and uninfested trees. By using paired samples, he was able to establish that there was a difference between the infested and noninfested trees but the difference in outward appearance and growth rate was so small that one could not differentiate a susceptible tree from a nonsusceptible tree.

Larson: Because this was over stocked, it probably weakened each tree.

Wygant: It could have weakened the whole stand. Currently the research being done by the Forest Service is directed in that fashion. It's a very difficult thing to test--to set up research plots to measure or determine what is susceptible or not susceptible. In other words, it is the total stand that is susceptible. The beetle is so aggressive that once an outbreak develops it's doubtful that any tree in a stand would be resistant to an attack.

Larson: So once they're established, they're established.

Wygant: That takes me back to a remark that has been ascribed to Dr. A. D. Hopkins who was head of the Forest Insect Research for the Bureau of Entomology following the outbreak of the Black Hills Beetle in the Black Hills in 1910. The first entomologists in the area were some workers of Dr. Hopkins and Dr. Hopkins himself. The outbreak in the Black Hills in the period from 1900 to 1908 reportedly killed about two billion boardfeet of Ponderosa Pine. Many of the mature stands in the Northern Black Hills were killed at that time. Dr. Hopkins made the remark that the Black Hills Beetle problem was over--that once the mature and the overmature trees were killed or harvested, the beetle

would no longer be a threat. In the meantime, the regrowth was established and they are equally susceptible to outbreaks of the Mountain Pine Beetle.

Larson: Which kind of shows the subjectivity of the scientific position. Each generation somehow feels that they have solved the problem and they have the truth.

Wygant: Yes, that's true. The insects adapt themselves to what's available to them as a food supply and the problem continues. The work going on now in getting the pine stands under good management is a very desirable objective and only time will tell whether these new stands will be resistant. But certainly with a more intensive management of our stands these bark beetle problems should decline.

Larson: Following the freeze in 1951 and the decline of the Engleman Spruce Beetle, you stopped the use of direct control against the Engleman Spruce Beetle in 1952. Were you then able to develop your techniques and try to expand, enrich, your scientific knowledge of entomology?

Wygant: Yes, it gave us more time to study the natural control factors--the factors that keep the population of our insects under control for long periods of time. We had several projects going. One, of course, was the study of the woodpecker habits in Engleman Spruce stands with endemic populations of Spruce Beetle. I think we found some interesting things in that the woodpeckers population in the Spruce stands are in direct proportion to the food supply. When there is a large food supply, woodpeckers do move into such areas and during endemic periods they're scattered over large areas. In other words, there may be no more than one pair of Three Toed Woodpeckers per square mile and during outbreaks as many as ten to twenty pairs per acre. We also studied the various insect parasites of the Spruce Beetle and found that they fluctuate to some extent but we couldn't determine that they were the primary controlling factors. They helped to hold down the increase in population but didn't actually control.

We also had some studies of the Western Spruce Bud Worm--trying to study their changes in population with various stages of the epidemic. Our techniques up to that time were not adequate to assess their value or predict their success in controlling the insect population.

Larson: Did you do alot of lab work during this period?

Wygant: Yes, we did alot of rearing of parasites and we did alot of laboratory testing of the new insecticides against the various insects. In particular, we were studying the effects of the gamma isomer of benzene hexachloride which is now called lindane. Dr. Cal Massey found that Black Hills Beetles allowed to crawl over filter papers coated with one-twentieth of a pound of lindane per acre would result in death of the beetles. Naturally, we thought we had a real find and an easy control method of the Black Hills Beetle. A pilot study was then set up for the Black Hills of South Dakota in cooperation with the Beltsville, Maryland laboratory. The test area involved over a hundred acres. We used dosages up to two pounds of the gamma isomer of benzene hexachloride per acre. We literally saturated the area. We had check areas where no spray was applied and we had check areas where only the diesel oil was applied without the insecticide. The application of the insecticide was timed very carefully by Cal Massey, who was on the ground daily to detect the first flight of the beetles. Upon the first day of flight the spray was applied over a period of two or three days. The results--there were more infested trees in the treated areas than in the untreated areas. To this day we can't understand why we didn't get better results because two or three gallons per acre were applied and the foliage and the bark of the trees literally glistened with the insecticide, but the results were negative. A similar case was encountered with DDT against the Pine Tip Moth in the Nebraska National Forest. The DDT was applied the first Spring at the rate of one and two pounds per acre. Excellent results were obtained that year and we thought we had a solution to the problem in these isolated pine plantations in Nebraska. The next year we made another test and got no result. A third test was made the following year and negative results were obtained. It points out in a way the need for actual field tests of insecticide to appraise their real worth.

Larson: The findings in the laboratory aren't necessarily going to match up with reality in the field.

Wygant: That's correct but it doesn't lessen the need for the laboratory test, to pilot test some of these new insecticides.

Larson: What effect did the publication of Rachel Carson's Silent Spring have upon the work you were doing?

Wygant: It had a very significant effect because people became more aware of the possibilities of the effects of the insecticides. It stimulated appropriation to study these alternate methods of control and in turn enable us to enlarge programs and studies of natural control agencies. It came at a time when we had few insect outbreaks in the area. We were able to orient most of our research program in that direction. The opportunity to develop a new biological control method is not too good when you're dealing with a native insect. In other words, the insect over a period of time has had an opportunity to develop a resistance to natural control factors. So the opportunities to develop new ones are not so great. The best opportunitie for biological control is against the species that are new to the region.

Larson: Or you could bring in so called natural enemies from outside the area.

Wygant: That's right.

Larson: What would you call them?

Wygant: Parasites, preditors, and diseases. A test was made for the use of a native virus for control of the Great Basin Caterpillar on Aspen in New Mexico. The thought there was that if this virus disease could be introduced into an area and its spread and development could be speeded up, the opportunity for more rapid control could be achieved. We got rather inconclusive results. I feel in the future that there is an opportunity for development of disease-causing organism for spraying infestations.

Larson: When you face the same problem that DDT has caused--that there are super bugs that will survive--that are immune to the effect of DDT and therefore their offspring are stronger and less vulnerable than before?

Wygant: Yes, I think so. The opportunity of this happening with forest insects is rather remote because you're not spraying annually with insecticides to control infestation compared with agricultural pests where infestations are sprayed annually or several times a year. Against forest insects, the spraying would only be done once in fifty or a hundred years so the opportunity for the pests to develop a resistance to it is rather remote.

Larson: If there are surviving insects, their chances of developing resistance are very slim anyway.

Wygant: Yes.

Larson: In 1954, the Bureau of Entomology and Plant Quarantine was reorganized. Did you foresee this coming?

Wygant: Yes, there was quite alot of feeling between the Forest Service and the Bureau of Entomology and Plant Quarantine. Perhaps the cooperation between the two was not what it should have been and the cooperation would be better if the division of Forest Insect Research were with the Forest Service. So there was much interest displayed. The Bureau of Entomology and Plant Quarantine was also reeling at that time under the publicity about the effects of DDT on animals other than insects.

Larson: It was cultural pressure.

Wygant: Yes, and it was felt that a more complete job could be accomplished if the two organizations were together. But I personally feel that by having surveys and biological evaluation separate from the actual administration of control has some plus values also. In other words control is often done for control sake. I think this can be pointed more toward agricultural pests but it has happened in forest insect projects. Biological evaluations are made to evaluate the course of an outbreak and to do control work only when absolutely necessary to prevent the death of trees. That is on the plus side. Of course, on the other side it's true the cooperation, if you're in one agency, would be more close. We've had, over the years, excellent cooperation on this region between the Forest Service and the Entomology and Plant Quarantine.

Larson: Did you do most of your work with the Forest Service prior to this?

Wygant: No, most of my work was in the Bureau of Entomology and Plant Quarantine up until 1954.

Larson: No, no, I mean did the Bureau cooperate--was it working with the Sorest Service?

Wygant: Yes, very closely. We felt as though we were actually part of the total program of forest management. We met with them as though we were part of the Forest Service and we often got criticism from our superiors that we were cooperating too closely.

Larson: So you already had a pretty good relationship with them.

Wygant: Oh, yes, very good and the transfer to the Forest Service was very simple and easy.

Larson: This coincided with Frank Craighead's retirement, right?

Wygant: Yes. Dr. Craighead was a very broad thinking individual. He worked very closely with the Forest Service but I think when Dr. Beal took over that was the opportune time for the transfer. The actual appraisal surveys and detection surveys were transferred at that time in 1954. The biological evaluation was left with the research branch of the Forest Service in the experiment station. We can notice a minimum change in our management activities after the transfer.

Larson: Beal became the director in 1951, correct--around 1951?

Wygant: I believe that's correct. Yes, 1951.

Larson: Were you asked to be--offered a chance of advancement at this time?

Wygant: No, it was a couple of years earlier than that. Dr. Craighead had wanted two assistants. He asked me if I would consider moving to Washington at that time and help him with the administration of the surveys and research branch. I told him that I had to decline for personal reasons. He fully understood and was very kind to me by allowing me to stay at Fort Collins.

Larson: Which has its benefits, too.

Wygant: Yes.

Larson: How do you view the work--I'm not trying to got too far ahead here but how do you view the work being done now in entomology now that it is part of the Forest Service? Do you think that it is being done with as much energy as before 1954?

Wygant: Well, I think so. We enjoyed a certain amount of independence in the old days--so called old days of the Bureau. I think on the plus side we're more closely associated and responsible for coordination of all our research programs with the people in cultural management and other aspects of forestry. Sometimes the overhead load posed by this change

seems exceptionally great but I think that's a characteristic of the times and not the situation.

Larson: So you think now is a better chance to cooperate in some organized plan.

Wygant: Yes, I think that's correct.

Larson: With the Forest Service taking over entomology, there had to be certain bureaucratic changes and you mentioned some of the good effects--there must have been some detrimental effects--and how do you see those?

Wygant: Well, when we were under the Bureau of Entomology and Plant Quarantine, the laboratory leaders had more flexibility and more opportunity to develop their own ideas and avenues of research. Following the transfer, a greater amount of supervision was provided, inspections and that sort of thing. It resulted in a greater cost of overhead. For example, in the Bureau of Entomology and Plant Quarantine the cost of overhead was five percent. Most of the money appropriated for specific studies reached the field. In the Forest Service, there are more levels of administration above us and more time consumed in getting proposals and projects approved and underway. As a result, I feel that there was a lessening of opportunity of the individual development of research than under the old system of management. I agree there was some abuse in the old days by individuals having such freedom but I feel that a researcher stands or falls under his own ability to size up a problem and attack it accordingly. Now it seems before a project can be undertaken there are many levels of authority and approval before the money gets down to the individual researchers.

Larson: So, you see the old Bureau of Entomology as being very decentralized in its leadership where you had a small staff in Washington but many of the decisions and recommendations were being made on a regional level.

Wygant: That's correct. Each laboratory leader and individual worker was given that freedom.

Larson: Whereas, the Forest Service is more centralized with much of the administration being done outside of the region.

Wygant: That's correct--more supervision and auditing of the projects that go from the region to the national headquarters.

Larson: This is probably a development within the larger Forest Service also. They have always maintained decentralized sort of administration but it appears that, from some research I did last summer for a management technology project, that they are slowly becoming more centralized too and this may just be the round of any large bureaucracy.

Wygant: That seems to be the current trend both within the federal service, universities and private corporations.

Larson: Can you describe to me developments and projects that were undertaken in the later half of the 1950s under the Forest Service. You stayed in Fort Collins your whole career, correct?

Wygant: That's correct.

Larson: Could you tell me what was happening around here during that period.

Wygant: During the late fifties--well, the program became more centralized and perhaps more and perhaps better coordinated with other research groups. I think that's one argument in favor of the consolidation. It brought the forest pathologist and the entomologists closer together and also the people in forest management research. Perhaps, in considering a total proposal, there are some advantages over this supervision and coordination of projects. The entomologists have been accused of doing too much so called pure research rather than applied research.

Larson: They're accused of doing this in the fifties? Or before?

Wygant: Yes--before especially. This was one of the arguments for the transfer of Forest Insect Research to the Forest Service.

Larson: Do you think you have been doing too much pure research?

Wygant: Before?

Larson: Yes.

Wygant: I think definitely not.

Larson: It sure doesn't look like it. It looks like you always had a major problem you had to deal with and didn't have too much time to research.

Wygant: Yes. Many of us had degrees in forestry as well as entomology and we understood the problems of forest management. We tried to get out proposals reviewed by forest management people. I don't feel we were off track at all or were into too much pure research because all our control methods were based on what I feel is pure research.

Larson: Would this then continue through the sixties, this trend?

Wygant: Yes, I think there's a feeling with the Forest Service between the research branch and the administrative branch. There is a continuous feeling by the administrators that the research people are not oriented towards their needs. This was true at the time I retired and I sense it's continuing.

Larson: You retired in what year?

Wygant: I retired in 1968 from the Forest Service at age sixty and then worked--

Larson: Excuse me. Before you go on with what you did afterwards, I'd just like to ask you if there were any other epidemics during the period, say, 1955 to the time you retired?

Wygant: Well, the Mountain Pine Beetle continued in outbreak form. During this period a feeling toward the effectiveness of direct control continued to decline. It was during this period that any long term measure of control would have to be through management plans--through management of the forest, which I think is good. That was what we were aiming for all along. In the direct control projects, we assumed only that we were buying time--protecting the forest from mortality by the insects until such time as the mature timber could be harvested and managed. Perhaps we were off base assuming that the management and harvest would come at an earlier date in the Rocky Mountains areas than it had.

Larson: During this time, a cultural movement in larger American society was moving more and more towards a wilderness ethic, if you will. You probably began that process at Silent Spring but it really came to full growth at the time you retired in 1968. What effect do you think this has had on entomological work?

Wygant: Well it actually started before that time. The feeling among our own group that--

Larson: I just mean in terms of a large society it began

at that time. They started to make certain demands and their voices got louder and louder and they became more politically powerful as the sixties came to an end.

Wygant: Yes, that's true. I'm in favor of wilderness areas. I think they're very much needed. There is a conflict between people who want to harvest the timber and those not wanting it to be harvested. There is a conflict about control in wilderness areas where outbreaks develop in the wilderness areas and spread to adjacent so called managed forests. There is a conflict that developed that--

Larson: Which should take precedence do you think?

Wygant: I think you have to deal with the individual insect and the problem. As soon as economics permit, more intensive management on the forests can be expected. There are few roads in the Rocky Mountain areas that permit prompt salvage and prompt logging control of outbreaks. In time there will be better means of protecting the commercial areas adjacent to the wilderness areas.

Larson: So you feel wilderness areas are where nature is to take its course for a national forest and you think that is a good philosophy to follow?

Wygant: Generally speaking, yes. One time the park service did quite alot of direct control with the National Parks. There is a feeling in the general public that you can maintain a nice virgin forest forever. The forests are continuously changing. Actually, such outbreaks result from human influence and so it's difficult to say whether we can ever maintain a natural area as a true natural area.

Larson: As long as man is present. And then, of course, the adjacent forest may be commercially used, therefore, the system is natural again.

Wygant: That's true. The outbreaks of insects happens over a large area not just a small localized area.

Larson: If then, in the commercial forests, there is an epidemic of say a Mountain Pine Beetle or any of the very harmful insects, you would feel that it would be best to go in and try to eliminate those in any way that is possible.

Wygant: That's correct. That would be my philosophy based upon the economics and what the future plans are for

that particular area. Now if there aren't any plans thirty or forty years from now, it might not be desirable to do anything now and wait for the next generation of trees.

Larson: I guess it's an issue that's very hot and lively now--the use of insecticides and other things has a highly emotional aspect to it. After your retirement in 1968, you didn't stop all activities. Would you like to tell about what you've done since then?

Wygant: After retirement, I received an appointment with the Department of Forest Science and the Department of Entomology at Colorado State University. For five years I had up to seven graduate students working on specific projects--woodpeckers affecting bark beetles, use of cacodylic acid for bark beetle control and parasites and preditors of harmful forest insects. I enjoyed this very much because after a number of years in largely administrative positions, it allowed me to get more deeply and closely associated with research projects. I found after five years that working with that many graduate students was a full time job--that I wasn't working with some of the personal projects I had planned after retirement. In planning for my retirement, we had purchased three hundred and seventy-five acres of which three hundred acres was forested--my wife and I--of Ponderosa Pine and Douglas Fir, about fifteen miles from Fort Collins. Our hopes were that when we purchased it in 1964, it would be an opportunity for Christmas tree production of the Douglas Fir and perhaps some saw timber and poles from the Ponderosa Pine. Immediately, it seemed the insects were trying to get back at me because within three years after we purchased it the Spruce Bud Worm outbreak developed in the Douglas Fir. We haven't had any saleable Douglas Fir trees for Christmas trees since. The outbreak is still continuing and it was supposed to last three years. Now it has lasted ten. The outbreak of the Mountain Pine Beetle in the Ponderosa Pine was getting started in 1964. For five years--excuse me this was in 1968--the outbreak was getting underway and gave me an opportunity to test some of the control practices as suggested. For five years I sprayed with either lindane or ethylene dibromide for control of the Mountain Pine Beetle problem on our property. None of our neighbors did so. So for five years the outbreak and the mortality kept increasing even though we controlled our population. I then pursued the method of applying lindane the first year and then for four more years with carbryl. We sprayed about four hundred specimen trees along the creek bottom. This has been very successful.

Larson: Could you spell that for me.

Wygant: Carbryl--C-A-R-B-R-Y-L. Another trade name is sevin--S-E-V-I-N. This is put on the bark of the infested trees just prior to flight. It kills or repels the attacking beetle. We have been able to save at least four hundred good specimen trees from the Mountain Pine Beetle. The good part of it is that a good stand of young Douglas Fir and Ponderosa Pine coming in. So somebody will have to harvest the Christmas tree production ten or fifteen years from now.

Four years ago we had a 30 acre fire on the top of our property that killed all the Douglas Fir. So, we had an experience with fire. This was caused by hunters who had left their campfire and were trespassing on the property that resulted in a total loss of timber and Christmas trees on thirty acres.

In 1976, the flood that hit the Big Thompson also hit our area. Neighbors estimated that eleven inches of rain fell in a twenty-four hour period. It washed debris and other material into our trout pond that had been so successful, and washed out some of the roads. It has been quite an experience for a person who had been in research for all the years--

Larson: It's ironic.

Wygant: We've had alot of fun working with the property and we're not discouraged because the appreciation and the value of the land has been very material since we bought it fifteen years ago.

Larson: Well, I think we're about at a close. Can you think of anything else you want to add?

Wygant: No, I'll probably think of something tomorrow I should have said but that's all right now, I think.

Larson: On behalf of the Forest Service and the Forest History Society and myself I would like to thank you very much and wish you luck with your property and any other endeavors you may undertake.

Wygant: Thank you very much.