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DR. FAIRBANKS: Do we have some other comments in this area either in relation to the trace elements or to the fire and trace elements?

Fire and the Environment—Application Section

Glenn Thompson, Co-Chairman

MR. GLENN THOMPSON: We are open for any points of discussion on the papers of Lotti, Givens, Bonninghausen, Cooper, and myself.

QUESTION FROM AUDIENCE: What is the limiting factor as to size of hardwoods that enable you to control them with fire?

DR. LOTTI: In a winter burning, generally, the burn in hardwood stands, the size is two inches d.b.h., the winter fire will knock down most, if not all, of the hardwood one inch d.b.h. and partially as you approach two inches d.b.h. and, when you get beyond two inches d.b.h., except under unusual conditions, then usually it's too dangerous to burn, or to successfully girdle the larger hardwoods for the fire. In summer fires, there is generally no limit to the size of hardwood that you can kill. We have set some extremely hot summer fires and killed hardwoods up to twelve or thirteen inches d.b.h. Those fires were even too hot for the purpose for which they were intended, that is, understory hardwood control. In those cases we suffered some mortality and as a result of my recommendation for the use of prescribed fire or control of understory hardwood and seedbed preparation, we advocate the use of winter fires preceding summer fires, the winter fires to knock down the heavy rough and to assure that the heat of the summer fires will not be too intense and thereby cause damage to the overstory. Mind you, you get crown scorch in the winter time and you've got dormant buds in the spring. If you get crown scorch in the summer time, there just aren't any dormant buds. If you don't kill the tree outright, you can make it quite susceptible to attack by various bark weevils.

MR. KOMAREK: Dr. John Phillips in Africa pointed out a number of years ago that some plants might actually have a kind of adaptation to fire where the cambium layer would have a resistance to what we would normally consider lethal temperatures and I wonder if in any of your fire control you have come across any particular plant or shrub that might be showing such.

DR. LOTTI: Complete resistance?

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MR. KOMAREK: Well, not exactly complete resistance but some resistance. In other words, say they were thin-barked shrubs that apparently could take considerable fire without being burned down and then regenerate.

DR. LOTTI: Well, let me answer you this way. I showed accumulated mortality to seed bearing on the chart and I also made the statement that the indicated mortality held true for tree species to a lesser extent. We found that Bayberry was the most susceptible among the more prevalent species.

MR. KOMAREK: What was the least susceptible?

DR. LOTTI: Oak and gums were in between.

QUESTION FROM AUDIENCE: Do you have a so-called scrub oak up there?

DR. LOTTI: Yes, we do.

QUESTION FROM THE AUDIENCE: Did you make any attempt to record temperatures of these fires?

DR. LOTTI: That is in Mr. Cooper's bailiwick and I think he will talk about that tomorrow. Incidentally, to any of you who may be interested, all this matter that I have talked to you about today actually is in public form in one or more of our quite recent publications. I have brought fifteen copies of one publication which I will place on the table, and I would appreciate it if you would help yourself and if you would like additional copies, I'll be glad to send them to you upon request.

MR. ROBERT BRITT: I'd like to inquire, in areas where prescribed burning has been used, what type of method do they use in annual maintenance of fire breaks with disks or with plows? How do they keep erosion down or do they have any guide lines to go by?

MR. THOMPSON: Did any of us cover that?

MR. BONNINGHAUSEN: We have that problem, and it's a difficult thing the way the fire lines were originally laid out to control the erosion, but what we are trying to do is break the chain or change the pattern of those lines. Many of our lines have been maintained for a number of years with motor patrols and are used for access roads, for logging, and things like that. In those cases we are constantly fighting erosion and we are trying to drain them with diversion ditches and drainage structures. Where we are plowing with a harrow, we frequently break the lines and we

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don't plow them through. We put barriers in between. That brings up a problem of having an escape at that point but most of our breaks are used as part of the control of fires, in other words, the breaks themselves usually don't stop a wildfire unless you are there to use them. If you are control burning you use them as a base. So we don't worry too much about those barriers. Where we can lay out the breaks properly, we have to take the topography into consideration and in some places cultivate a grass of some sort and keep it mowed.

MR. THOMPSON: Anyone else?

MR. BOB COOPER: I could just mention—there's a possibility of using fire retarder on occasion in place of plowed lines for up and down hill breaks.

MR. THOMPSON: There are two research bulletins of the Forest Service, the last one just a few years back, entitled "Grazed Fire Breaks." Are you familiar with that or have you seen it? Joe, would you care to discuss your knowledge of that?

MR. RIEBOLD: No, I have never done any prescribed burning in Piedmont country at all.

MR. THOMPSON: Your problem here has been to go to disks instead of plows in annual maintenance of fire breaks.

MR. RIEBOLD: Well, our maintenance problem is not annual. It's periodic. As often as we return to a block, we'd like to use the same plow lines. We put them in with a Mathis plow and so far I have not been able to get my hands on a suitable maintainer that would rework a Mathis line. Several companies have come forward with outfits but we have tried them and when they took them home, we were all sadder and poorer.

MR. THOMPSON: We will wait until the next meeting then to get a full answer. Any other points of discussion?

MR. GEORGE WHITLOCK, U. S. Forest Service: There has been considerable comment about the cost of prescribed burning and also the technical man doing prescribed burning. I would like to make a brief comment on these too. One, I think managing national forest land is much different from managing a game plantation. Eighteen thousand or twenty thousand acres is considerably different from managing 150,000 or 200,000. While you can take a man who is sometimes only capable of taking a mule and plowing cotton, you can't take that same man and use him marking timber

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and scaling timber and guarantee a man how much timber he will have when he buys it. So, therefore, when you burn a large acreage for a ranger district, you may not have a man that gets into that acreage once in every five, six or seven years. You have to have a man who can take an aerial photograph to start with, and to fire lines two miles into some back country, pick up several islands and come back and know which side of the line to set the fire on. So, therefore, your cost is considerably higher than someone who knows a plantation and can set fire from here to here. Also, in our case, we don't have much labor any more that is capable of performing only one task. We have to have a man that can make decisions, therefore, the man who has more than just the minimum I.Q. to perform menial tasks is necessary in this type of woods burning.

MR. THOMPSON: You are making a good argument to keep rangers in place.

MR. KOMAREK: I might say we are talking about two different types of operations. On a large game plantation with extensive farming you have a fixed agricultural labor overhead. Economics dictates the use of this labor for burning and does not justify the cost of a professional forester. Furthermore, on a plantation burning is on a maintenance, annual basis which is the cheapest kind of burning.

In the past there was objection to the use of fire because of cost and we used to hear figures of two and three dollars per acre for burning. Now, Mr. Riebold and others talk of eight to thirty-five cents per acre. This indicates much progress has been made in more efficiently handling burning in the woods.

MR. RIEBOLD: May I add a footnote to Lotti's discussion? There was a question about summer burns, and since Tom isn't here and I was associated with him for a good many years in South Carolina, let me make three points. When we realized that our hardwood understory problem in Loblolly Pine was becoming as bad as it was about 1942 we began winter burns. As Tom told you, we could control everything up to an inch or so in d.b.h. It would sprout again, but by the periodic use of fire throughout the full pine rotation beginning at, say, fifteen years of age we could control understory hardwoods. But there were some places where the hardwood got ahead of us and we had three- and four-inch hardwood in middle-aged stands of pine. Either we could let

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the hardwoods go and then deal with it by mechanical means at the time of regeneration or we could do what John Hills suggested—summer burns. After he had taken the ten-year fuel accumulation out in the preceding winter fire, he could put a summer fire through there, using strip head fires, and kill hardwoods up to three or four inches in diameter. The few that escaped we thought were not serious and would probably be beneficial. After one summer burn, the woods were open and parklike, and succeeding winter fires on our usual pattern of four or five years would keep them under control. Tom Lotti, at the Research Center, realizing as all did that our winter fires and even our single summer fire did not kill root stocks, took a different approach and put three successive summer fires on an area which he was desirous of reproducing. He had found on smaller plots that the successive summer fires killed root stocks, not only the aerial parts, as we were doing, so that after three successive summer fires they had open parklike woods. They would stay open during the whole period of the pre-harvest release of the seed bearers and the seeding cuttings. The seedlings would appear without any hardwood competition. He was ahead of us so far as having controlled hardwoods. We had tried summer burns in advance of seed fall. You cannot always get the timber cut just at the time of seedfall as you would like. If it isn't going to be cut, then there's no point in putting a prescribed burn on it just before seedfall. We found that the practice we had begun of putting a winter burn on the area before each sale so that the fuel was removed before cutting was equally usable in the shelterwood. We found in Loblolly Pine all we needed to do was put in a winter burn and then if the purchaser cut it anytime during a year or two we got satisfactory reproduction. The result is satisfactory enough. So the impression that we are using summer burns as a practice on the Francis Marion National Forest in South Carolina is not so. The usual practice is just the winter fire. Lotti was on an experimental forest and demonstrates his point very well, but it's not standard practice nor do we suggest it to people.

MR. THOMPSON: Thanks, Joe. I might explain that Einstein's advice to Roosevelt on nuclear development has brought on a new era for research. So many of the better things, whether with trees, birds, mammals, or other animals come about more or less as an accident so the whole theme of research is to investigate nature. We call it science, this starting on a course of investigation which

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may uncover many things, good or bad. We believe this new theme of research understands that and anticipates it. To those people who want to kill hardwood, this thing that Tom showed us is just one of the points of research results, that can kill practically any hardwood under thirteen inches in diameter with three consecutive summer burns. This may be useful to somebody who wants to clear timber off the land. As Mr. Stoddard has well pointed out, improper use of that can be very destructive. My plea is, let's challenge the use of research rather than research. You are defending the Forest Service's application of that, Joe, which is right.

Mr. Stoddard is the only one who has really spoken out on the item of conducting proper controlled burning. We really are faced with something here, challenging us to make the distinction between an art and a science. The best burning that's been done so far is by those people who understood fire well and had a feel for weather plus a sure understanding of the objective. I think of 2,000 people in the Forest Service in Region 8, there are maybe fifty that understand how to burn. We should have 800 or a thousand with knowledge enough to do it. A lot of people have quit because of bad luck.

The research that's being done is pointing up some of the basic things that we can measure. The forecaster at the U. S. Weather Bureau can get us within two per cent even on a thirty-hour prediction in temperature and humidity. The wind is still elusive. The possibility of determining many more things scientifically holds promise. We are really up against it if we have to stay to the art of it. I understand you have about six people, Herb, that can be turned loose to burn?

MR. STODDARD: Well, I kind of hesitate to turn myself loose to burn. We've got to take calculated risks in this world, and I don't think we can possibly ever use fire on a large scale and get the results we ought to get unless we do take those calculated risks. I think we should make some arrangements in case our calculated risk proves that it was calculated wrong. We'd better be able to get in touch with somebody quick to help us out of a situation. That's where I think these forest rangers might help. We'd like to be able to call on them when we need them. We don't want to bother them in our routine but maybe if we would have one fire out of a hundred that would go bad, we'd need

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them. If we didn't burn up a lot of timber, we might die of heart failure in the fire. But I do think really one of the best advances we can make is to train a lot more men carefully and have many crews with the best men that we can get in the Forest Service. The trainer is mainly there to show forty or fifty others just how he conducts his burning; you are always going to such men—ones who are outstanding in that particular field. Some take great interest in it and know a lot about the weather. The countryman knows a lot more about weather than some people give him credit for. I've got a son here who I would stack up against the U.S. weather man. He happens to have an interest in weather and I consult him constantly about it. I just believe in getting the best brains together that you can and not be timid in the use of fire. Some men will never have the boldness or be willing to take calculated risks and do cheap burning over long periods of time. They are just not temperamentally suited to it. They are too timid, and that's one thing I learned long ago that there's no use trying to make an expert man in the use of fire who has a timidity in his whole makeup. I'll bet you've got talent if you would just make it known that you wanted to develop a man who had a great interest in that line. If you thought he had ability and you had a school where he could go and see expert burning done both day and night, then we might be on solid ground and making progress forward rather than just tolerating labor that doesn't care anything about the job after they quit at six o'clock and leave a fire to spread and do hundreds of dollars worth of damage. To my mind, this sort of things calls for dedicated men who will do whatever has to be done, physically and otherwise, to whatever extent it can be expected, and I think they should be rewarded in some manner if they do that kind of work and give that kind of service. I think every man in here today is a dedicated man in his own field and we should make it worth each one's while to let him work in what he would like to work in most and do the most good. I think every man knows what he is best adapted to do.

MR. THOMPSON: We have a pretty good program underway within the Forest Service. We are sending people to special fire courses at Yale and the University of Florida, and we have our own training program within the Service. In South Carolina we have entered into an agreement in which the state and private foresters who are interested in burning attend burning schools. They pay their way but we need to develop the program further.

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MR. STODDARD: I believe you are on the right course and going in the right direction.

MR. THOMPSON: I think with this type of group that might be one of the projects we could expand further, whether it be by promotion or solicitation or anything like that. You folks have gotten pretty well started on it already here in Florida.

MR. BETHEA: We found generally here that this is the situation with us. Usually a good fire man is a good fire man whether it's on wildfire or control burning. Usually it takes a man who can envision the entire job and has enough background and knowledge to grasp the situation and then have the ability to apply it.

MR. STODDARD: He's got to have the interest though.

MR. BETHEA: That's right and he's got to have the capacity to envision the whole project and not just one element.

MR. STODDARD: He's got to have incentive.

MR. BETHEA: That's right. A good many of the mistakes in control burning are avoidable. For instance, some of the leg men will even do such things as set the fire on the wrong side of the line.

FROM THE AUDIENCE: If you will permit a comment from an outsider, it seems to me that I detect a note of a good bit of self-questioning, but I don't think we should have it. You are so far ahead of the rest of the country that you shouldn't have it. My forestry experience has been in northern New England and in the Northwest. For various reasons—fuel type and topography and past history—we have been not only timid with fire; we have been scared to death. We have tried for many purposes to use fire in small experiments where we are concerned about moose management and woodcock management and in many other ways, and we know a little bit maybe about Ponderosa Pine control burning, but it's just a scratch on the surface compared to your knowledge. Mr. Stoddard mentioned perhaps we didn't have any woodsmen among our professional men. I won't necessarily admit to that, but we might be in the same position as Daniel Boone. We never admit to being lost but we have been confused.

MR. THOMPSON: Thanks very much.

BOB COOPER: I'd like to ask Bonny or John, in the farm forestry program in the state, is the farm forester permitted to help the landowner if he requests it?

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MR. BONNINGHAUSEN: We expect and require the farm forester, when he works on a management plan for a landowner and prescribes particular treatment for the stand, that he recommend prescribed burning where he thinks it should be applied. The extent to which he helps depends upon the individual forester. We don't tie his hands. They deal with very small acreage, as a rule, and most of their work is with farm woodlands. A lot of their burning is done on twenty, forty, or sixty acre patches. Frequently the farmer and his son and his hired hand get out and work and the farm forester will work with them. We certainly keep them informed—and what he does do is to follow a pretty well established pattern of fire breaks in his recommendations in order to safeguard a man's timber. If the farmer has the equipment to do it himself, he does it. If he doesn't the farm forester urges him to contact a ranger to make arrangements for plowing. We do this for a nominal charge. The farm forester also tells him that the forest ranger will stand by so in that way we get a lot of burning done on small woodlands and most of it seems to be very satisfactory. But we do insist that the recommendations be made and that a forester makes the recommendations.

MR. BETHEA: I don't believe Bonny mentioned this. The first fifteen minutes of plowing is free or, as we call it, "complimentary." Then after fifteen minutes there is a nominal charge that Bonny mentioned. All suppression crews have to submit a weekly report and in this weekly report they show the number of burning assists that they have made during the week. That means the number of people that they have assisted in burning during the week. Rangers and the farm foresters work together to help a man burn. We help them burn but we can't assume any liability. We do encourage the burning and help to the extent that we can.

MR. THOMPSON: There are a few things that would not be in the nature of how to conduct a fire but might answer your question about what to do about deer. I don't believe it's publicized, is it, exactly what species are proper for deer food, what is palatable, and what fire will do to each of them—what kind of treatment. That would help a lot in our determination of whether or not we wanted to burn, and of what kind of fire to use.

MR. GIVENS: There are some lists but they are not complete.

MR. THOMPSON: We very definitely need to know what fire is going to do to a particular plant in that area and what the con-

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dition is. We might wipe it out. We have done that in some of the burning in the West—practically eliminated the best deer food.

MR. GIVENS: I think that comes back to the point I raised in connection with research. Actually we need to determine the quality of the ground cover that is produced as a result of fires, controlled fires. We don't know, frankly, in certain sections. We don't know too much about that.

MR. THOMPSON: There is no precise publication that anyone could get.

MR. GIVENS: No, it just shows how far we are behind, I guess.

MR. STODDARD: Some people have found that where they are producing deer commercially, for the market that they can step up their yearly kill to a tremendous figure by intelligently cutting scrub oaks and things like that, not only for the deer to graze on top but for the suckers to use. Sometimes the deer population is so great they'll actually kill those suckers. I've seen situations in Wisconsin where that's happened, and the man who was running that was a very close student of the subject. He has done all sorts of things experimentally as to what species to cut for suckers and all sorts of things. I think the field is almost unlimited for study.

MR. KOMAREK: Yes, that is a tremendous field. That's Wallace Grange at Babcock, Wisconsin. I was up there last summer and he has found in his own operation right now that because of the demand for certain types of pulpwood it is better to cut the hardwood and let it sprout than it is to burn it. That's economics again. Right now he is cutting instead of burning.

MR. MOORE: Dr. Grove(?) made quite a study on deer on the Ocala National Forest a few years ago. I'm sure he's got something on deer food in that, but whether he did anything in connection with fire or not, I don't know. There might be a key in that publication.

MR. GIVENS: Well, this problem has a very practical application as far as we're concerned because one of the things that we are afraid of in connection with our burning on the Piedmont refuge is that these winter burns may create conditions that will actually cause a rather rapid explosion of the deer population. We may accelerate that thing and unless we've got adequate methods of harvesting we'll be in real trouble. We would make the situation worse instead of helping it.

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MR. THOMPSON: Someone brought up a field we should investigate further—that is setting fire and the methods of burning. Various men have hit upon what is called spot setting or the alternate spot system. The potential in this is something startling. If we could find some way of spontaneously igniting such a system, we could burn the land surface of the earth in fifteen minutes. We wouldn't have to worry about weather at all. The Forest Service is working with different equipment companies and the nearest we have right now is a small fire grenade, which you strike and throw out. Using those from a helicopter shows some potential except that it's expensive. We've tried it on Francis Marion and also in North Carolina. The fire research people in the Academy of Science headed by Dr. Hottel at M. I. T. say, for instance, that it's possible now with a semi-portable machine to either suppress or ignite a fire up to three miles with a ray. Though we've learned to be pretty careful when we go on record with what can be done with fire, the future holds much promise. Now that the American people particularly have begun to accept the results of research, maybe that's our opportunity to promote fire.

I feel very privileged to have had this opportunity to be here and help take part with all of you. Thank you.