Panel Discussion: Managed Longleaf Pine Forests and Red-Cockaded Woodpeckers

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Fran James:

In this session, we will focus on the endangered Red-cockaded Woodpecker and its relationship to the longleaf pine ecosystem. We will show that past silvicultural practices are the primary cause of the woodpecker's endangered status but also that, without pine silviculture, the bird would probably be extinct today. The species was common in the old growth longleaf pine forests of presettlement times. It remains only where particular elements of that ecosystem still are present. Such places are virtually all in managed timber on public land, mostly national forests and military bases. Our purpose here is to assess the present situation and to discuss ways in which southern pine forests can be harvested simultaneously with the support of healthy Red-cockaded Woodpecker populations.

Our three participants are experts in Red-cockaded Woodpecker research and management, and tremendous expertise is present in the audience. Ron Escano from the U.S. Forest Service has been the Threatened and Endangered Species program manager in Region 8, the Southeastern Region. He has been in charge of the management of Red-cockaded Woodpeckers in national forests for the last four years. Ron has recently moved to Asheville, North Carolina, where he is the resource staff officer for the national forests of North Carolina. Ralph Costa has been the wildlife biologist for the Apalachicola National Forest here in northern Florida for the last few years. He worked on the Kisatchie National Forest with Red-cockaded Woodpeckers before he came to Florida. Jeff Walters is a member of the Zoology Department at North Carolina State University; he and his colleagues in North Carolina have the most complete long-term data on a marked population of Red-cockaded Woodpeckers. The excellent papers they have produced recently have led to many new insights into the breeding biology and life history of the Red-cockaded Woodpecker.

In the audience, we have people who have worked with and published about the Red-cockaded Woodpecker for longer than any of the people up here in front of you: Bob Hooper, from South Carolina; Phil Doerr, from North Carolina; Jay Carter, from North Carolina; Todd Engstrom and Wilson Baker, from Florida. I'd also like to mention Chuck Hunter of the U.S. Fish and Wildlife Service. Chuck is involved in the federal regulation of Red-cockaded Woodpecker recovery efforts. The entire issue has become an economic and political one, as well as a biological one. I hope all these people in the audience will take part in the discussion.

If the Red-cockaded Woodpecker is going to persist, forestry practices will have to be more sen-

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sitive to its requirements. Foresters consider themselves to be ecologists, but the timber industry has not made much progress in this direction when managing commercial timberlands. The objectives of the industry are primarily venal. Its methods are dominated by clearcutting in 30 to 60-year rotation cycles, a practice that has driven to local extinction many animals and plants of the original southeastern pine forests. The Red-cockaded Woodpecker has become a focus of this phenomenon because it has legal protection. I'll give you a nice quote from the *Atlanta Journal* by Charles Seabrook:

"To the timber industry, *Piciodes borealis*, an unassuming little bird that nests only in aging pines, looms as the biggest threat since aluminum siding."

Unfortunately, even on public lands, the profit motive has dictated many management decisions.

This conflict of objectives between conservationists and timber interests is why we are here today. In the United States the economic value of timberlands in the Southeast is second only to that in the Pacific Northwest, where protection for the northern Spotted Owl (*Strix occidentalis caurinus*) conflicts with industry's hopes to clearcut old-growth timber on land managed by the U.S. Forest Service and the Bureau of Land Management.

Most people have never seen a Red-Cockaded Woodpecker. It is a small bird, only seven and a quarter inches long. It still occurs from Virginia to Florida and west to eastern Oklahoma and eastern Texas, mostly in small isolated populations on public land. Some populations are in loblolly pine (*Pinus taeda*), and the few colonies that remain in Oklahoma and western Arkansas are in shortleaf pine (*Pinus echinata*). The birds maintain cavities in old living trees that have heart rot, and partly because longleaf pine is an exceptionally long-lived tree, the Red-cockaded Woodpecker probably evolved in longleaf pine forests. The birds don't even make cavities in longleaf pines until they are nearly 100 years old. Typically, loblolly and shortleaf pines aren't so long lived, so the rate of cavity turnover is greater than it is in longleaf pine forests.

We'll have to begin with a few definitions. Red-cockaded Woodpeckers live in sedentary family groups called clans. The U.S. Forest Service use to refer to the site or the group of trees where a family group lives as a colony, and they refer to active and inactive colonies, according to whether or not those trees show signs of recent activity by the birds such as fresh resin wells or dripping sap. Censusing for Red-cockaded Woodpeckers in the past has often been based on censusing the appearance of the trees. Finding out exactly how many birds are present and what the population trends are is more difficult.

Breeding pairs of Red-cockaded Woodpeckers often have helpers. Some male offspring stay around and may help their parents rear young in the next year. Jeff will talk about the implications of this interesting breeding system for management. Some of the most exciting management tools that we have now are related to the breeding system and to the dependence of the birds on their cavities.

The Red-cockaded Woodpecker was designated as endangered in 1970, and by that time the timber industry had cut most of the original giant longleaf pine forests. Here's a quote from the *Journal of Forestry* in 1969:

"Barely seven million acres of longleaf timber remains in large ownerships in the South, almost entirely in natural stands. The current annual rate of harvesting for regeneration is 1.1 million acres. It seems fair to assume that the largest share of this acreage is over-mature timber, hence, that this category will be liquidated within a decade."

Between 1970 and 1980 virtually all remaining old-growth forests were cut.

Dissent exists within the U.S. Forest Service about their own policies of timber harvest. F. Dale Robertson, the chief of the Forest Service since 1987, has been subject to pressure stemming from complaints, even within the Forest Service, mostly dealing with the northwestern situation and the destruction of old growth there. Recently, he said:

There's a change going on in society and the Forest Service can't just ignore that. We intend to be more environmentally sensitive.

That was in response to Mr. Jeff DeBonis's letter of resignation from the Forest Service, in which he said:

Our basic problem right now is that we're much too biased toward resource extraction industries, particularly the timber industry. We support their narrowly focused, short-sighted agenda.

Since 1970, there have been recovery plans,

management handbooks, and two symposia about Red-cockaded Woodpeckers. In March 1990, we had a "summit" meeting at which 24 experts, managers, and biologists got together and produced a document in which they concluded that, if we're going to save the Red-cockaded Woodpecker, we must have new policies that require much longer rotation cycles for timber management and much more control of mid-story. The experts agreed that this situation is, in fact, a conservation emergency.

Just how many Red-cockaded Woodpeckers exist today? I compiled a list of people paying attention to Red-cockaded Woodpeckers and sent them a questionnaire. From their responses, I have concluded that the sites of approximately 4,000 clusters of active cavity trees ("active colonies") were known in 1990. Of those, about 1,100 are in Florida, about 600 in each in Georgia and South Carolina, 500 each in Louisiana and North Carolina, 250 in Texas, 150 each in Alabama, Arkansas and Mississippi, and fewer than 20 in four other states. Not all of those clusters of trees harbor breeding pairs. Many have only single birds, and we know, from our own work on the Wakulla District of the Apalachicola National Forest, that just counting the active trees is not an accurate way to assess the health of the population.

Ron Escano will tell you about the history of Red-cockaded Woodpecker management within the U.S. Forest Service and what a big crisis we're facing. He, personally, has just developed some exciting, new long-term guidelines that he is proposing for adoption as Forest Service policy.

Ron Escano:

I'll give you a brief summary of RCW management on National Forest lands, then focus on some of the points that have been proposed in the new long-term strategy for their management, taking a look specifically at the longleaf pine ecosystem in relation to the long-term management for the Red-cockaded Woodpecker. The silvicultural alternatives are discussed in the proposed new guidelines.

In 1975, the U.S. Forest Service started its formal Red-cockaded Woodpecker management with the publication of a handbook. That handbook has gone through a series of revisions and was last revised in 1985. Woodpecker management on Forest Service land also has evolved. First, back in the mid-seventies, we just tried to protect the cavity trees. By 1985, the scope of management had expanded to consideration of the management of colony sites and foraging habitat, but still the focus was on the colonies.

Today, we have a proposal that broadens the scope again to management on a population basis--an ecosystem basis, if you will. Our proposed long-term management strategy is now out for technical review. The attitude of management in the Forest Service has been evolving rapidly over the last two years, partly in response to a hectic litigation schedule with all kinds of appeals; it's been a lot of fun. Since the Forest Service lost a lawsuit in Texas, it has extended interim guidelines to most national forests. In the last month, the Apalachicola and the Kisatchie have been brought under interim guidelines. A recent appeal decision in the appellate court in New Orleans has opened the door to our putting together a proposal for interim guidelines development and application to the national forests in Texas, which have been under court-order management for the last two to three years. So shortly we'll have a standardized management under interim guide direction across all woodpecker habitats on national forests in the southeast.

One of the key points for managing longleaf woodpecker habitat according to the interim guidelines is protection of the oldest age classes of trees. There's no stated rotation age, but it's a de facto 120-year rotation. The guidelines also promote the conversion of off-site pine back to longleaf, and aggressive mid-story control. Shelterwood regeneration techniques have been modified to strengthen the short-term value for Red-cockadeds. The primary, overriding premise of the interim guidelines is to preserve all silvicultural options for a long-term strategy. The short-term policy is to protect the key values of woodpecker habitat while we make decisions on long-term policies.

Let's now briefly summarize the key points in the proposed long term guidelines that are out for review. They stress longleaf pine ecosystem management, emphasizing growing-season burning and natural regeneration techniques. They also address other forest types, across the range of the species. They set aside large, contiguous areas for woodpecker management by assigning management policies to areas large enough to achieve recovery objectives at the population level. The size and configuration of those areas will be based on RCW demographics, the work that Jeff Walters will describe to you.

The silvicultural objective in these areas that

are allocated to woodpecker management is basically to provide a sustained supply of high-quality woodpecker habitat with timber production as a byproduct. Timber yield will be lower in these areas, but it will be predictable and sustainable. Another key point is that management intensity will vary across various populations, depending upon population size and trends. Under current policy, one set of guidelines is expected to apply across the whole range of forest habitats, across the range of the species. Now we will try to match management to the local conditions.

The proposed guidelines discuss longleaf management for woodpeckers in the long term, including greatly lengthened rotations. We must provide a flow of potential cavity trees with sufficient heartwood to support cavities and a high enough incidence of heart-rot. Such trees must become available fast enough to offset mortality rates of existing cavity trees.

We've examined the documented pathological age for longleaf, and it's generally two to three hundred years. Heart rot rates vary by site condition; on poor sites it comes in at 70-80 years, on average sites at 80-100, and on good sites not until well over 100 years of age. We have set the proposed rotations at below pathological age but well above age of onset for of heart rot so as to assure a high level of heart-rot incidence and low turnover rates of cavity trees. Our proposals vary by site; the poorest sites would have the shortest rotation, because the desirable characteristics appear at a younger age on the sites with slowest growth. Recommended rotations are, on poor sites, 100 years, average site, at least 150 years, and on good sites at least 200 years. I believe that, on national forest lands in the Southeast, we have turned the corner in the loss of longleaf. We will see a significant increase in the amount of acres of longleaf in the next decade on national forest lands in the Southeast.

For timber management, both even- and uneven-age natural regeneration techniques have been incorporated into the proposed new guidelines. Shelterwood and group-selection management are the two main techniques that are proposed. Both even-aged and uneven-age natural regeneration can produce good woodpecker habitat, but both must be modified to assure a reliable sustainable supply of potential cavity trees. A key point is that shifting to uneven age management, per se, does not guarantee good woodpecker habitat. There's actually a risk of failure to produce good woodpecker habitat with uneven-age management techniques. One has to have the ability to implement fire so as to be able to control the mid-story and prepare seed beds for regeneration, but at the same time not destroy the regeneration already in place. As I see it, the only difference from the woodpecker's point of view between even and uneven age management is patch size. The smaller the patch, the more you tend toward group selection. The individual tree is the smallest patch you can provide. On the other end, as patch size increases you get into even-age management. The point at which a "large patch" becomes an even-age stand is not really important.

What's the bottom line? We can't hang our hat on any one system. Let's not spend our time arguing whether we should be doing uneven-age or even-age management. Let's spend it deciding what condition we are trying to produce and applying whatever method or methods are appropriate, based on the specific site conditions, to produce that desired condition.

A lot of silvicultural techniques are not proven to produce old trees. We need to try all of them, both even age and uneven age, various patch sizes and burning regimes, on the different sites that we have across the range of the woodpecker with adequate monitoring to make the adjustments that are going to have to be made. Let's set up a series of applications to assure that we can discover those that will produce high-quality woodpecker habitat.

Ralph Costa:

I'm going to give you the perspective of a person who's been on the ground for quite a few years. My most recent task has been habitat inventory, habitat management, and banding to facilitate augmentation in the Apalachicola National Forest. Through those three processes, we have collected a lot of data. I'd also like to acknowledge the people who have collected most of this information. Four key people are Greg Waters, who's now a graduate student at Auburn University; Orlando Rivera, who spent his first couple of years in the Forest Service in Puerto Rico working on the Puerto Rican parrot project, then worked for us for three years, and now is with the Florida Department of Natural Resources; John Kappes, a graduate student at the University of Florida; and Chuck Hess, a graduate student of Fran James's and an employee of ours working on woodpeckers. This list gives you an idea of the quality of effort that has gone into data collection.

The Apalachicola National Forest consists of the two biggest districts in the southern region of the Forest Service. It also has the largest population of Red-cockaded Woodpeckers. Our program has included habitat inventory, colony marking and mapping, population trend surveys, habitat assessment, habitat improvement and maintenance, banding, and augmentation. The augmentation program has produced some data on breeding success. We also have a vigorous information and education program. Whenever organizations or schools ask us to speak about Red-cockaded Woodpecker conservation, we respond.

There are 212 management (compartments) units in the national forest, about 1,500 acres each, half a million acres total. Obviously, that cannot be inventoried on an annual basis. Every compartment is surveyed for woodpeckers about every 10 years. Some of the data are old, and it changes all the time. As Fran James pointed out, each colony does not represent a breeding unit. An active colony, also called an active cluster, is an area where the trees show signs of woodpecker activity, which could be supporting just a single bird. There are some dramatic differences between the Apalachicola District and the Wakulla District. There are close to 900 clusters, both active and inactive, on the Forest. The western Apalachicola District has more active sites and has a lower proportion of inactive sites. There are 17% inactive colonies on the Apalachicola District and 36% inactive colonies on the Wakulla District, so, the percentage of inactive colonies is twice as high on the Wakulla District as it is on the Apalachicola District.

The inventory work that the Forest Service has accomplished includes a 1980-81 survey conducted across the whole range of the woodpecker on Forest Service land and other public lands in the southeastern U.S. On the national forests in Florida, the work was done with a contract. Forty-one of the 212 compartments in the Apalachicola National Forest were randomly drawn and every acre that was deemed suitable for woodpeckers (i.e, had trees more than 30 years old) was surveyed. Mike Balboni, the biologist between 1982 and 1987, surveyed almost 80,000 acres by himself. Since 1988, when I got here, we've reinstituted the resurvey of the 1981-82 contract compartments. That resurvey involves going back to those same 41 compartments and systematically searching them. That's what John, Chuck, Greg, and Orlando have accomplished. What that's going to give us is a population-trend estimate from 1981 to 1991. We are now within five compartments of completing the resurvey.

For timber coordination reasons, we enter our compartments on a 10-year schedule. We also inventory woodpeckers to make sure that we're satisfying our woodpecker guidelines. We have systematically traversed 169,745 acres on this forest in the last 10 years looking for clusters of cavity trees.

In each case, we map the cluster, determine the direction and distance from every cavity tree to every other tree, and make a field map, so that anyone could look at our data base and find those trees. We paint and tag the cavity trees. We classify the trees as active or inactive, and we record habitat conditions at the clusters.

To date, we have visited, painted, and tagged 285 clusters, which represent 32% of the clusters on the forest. Prior managers tagged the trees with aluminum tags, but the trees weren't painted or mapped, so we can't instantaneously run out and clean up the data set.

So, for 1981, I have 41 compartment maps with woodpecker trees on them, either active or inactive. We have the same thing now in 1991. There are different ways we can compare them. Bob Hooper and others were instrumental in analyzing the first set of data, and obviously, we're going to need his assistance on the second set. What we've done is to impose the new rules, handbook guidelines, on the 1981 data and aggregate the dots on each map into what we think would have been clusters back then. Then we compare them with what we know are clusters in the 1991 data. That's how we got the two numbers I'm going to give you. The other system we can use to compare the 1981 data with the 1991 data is to use Harlow's method of a 460 meter circle.

In the cluster analysis, we've accounted for things like new colonies, previously undetected colonies, status changes (active to inactive, inactive to active), and compartment changes (that is, changes in our judgement of what compartment to score them in, not necessarily movement of the colony). We've lumped and split colonies. That is, we've sometimes taken two clusters considered separate in 1981 and put them together, because we have breeding data to show that they are one now, and we've split some into two. We also have data on additional compartments, to a total of 79, that have had some sort of previous survey. Fifty eight compartments now in the forest have been sur-

veyed at least twice, and 21 have been surveyed three times. The collection of data was somewhat different, but I think it's still valuable.

With five compartments still to finish, we have exactly the same number of clusters that we had in 1981. However, there are some disparities in the districts. The Apalachicola district has increased by 8, and the Wakulla district has decreased by 8. That's a 17% decrease in active clusters on the Wakulla, and a 1% increase on the Apalachicola district. These figures are going to change. We have, as I said, 4,500 acres left to survey for this trend, and in those 5 compartments in 1981, they recorded 22 active clusters and 11 inactive. So, we still have 33 to look at, plus anything else that's happened.

There are some differences between management schemes on the districts. I've used Ron's and Jeff's information, which went into Ron's long term strategy, and developed subpopulations on the forests, drawing the maps and using the system that they've designed. There is some demographic isolation in the Wakulla District population. Several differences, both in densities of birds and in management regimes, might be creating some of the differences that we're seeing between the two districts. Very commonly, perhaps 30% of the time, our clusters do not meet minimum foraging substrate requirements, as defined by the U.S. Fish and Wildlife Service in Gary Henry's bluebook. It's a function of past cutting, pine habitats broken up by ti-ti swamps, private lands, and other factors. Even when we have satisfied minimal foraging-area requirements, the foraging area very often is not contiguous.

On the Wakulla District, 67% of our slash pine is in the 0- to 35-year age class. You can do a little bit of quick math and figure out what kind of rotation we're using. We also have estimates of approximately 30,000 acres of off-site slash pine that used to be longleaf pine habitat on the Apalachicola district. We're going to go back and fix that for woodpeckers. On the Wakulla District 32% of the longleaf is in the 0- to 35-year age class. That's bordering on an 85-year rotation. On the Apalachicola District 29% of the longleaf is in regeneration.

When you take the total number of active clusters, 500 on the Apalachicola District and 187 on the Wakulla District, and divide that into total managed acres of slash and longleaf for each district, you end up with a density for the total pine of 275 acres per cluster on the Apalachicola District and 791 acres per cluster on the Wakulla. If you take out the 35-year-old age class and below, knowing that we don't have birds using that habitat at the moment, the figures become lower. We have 180 acres per cluster of habitat suitable for woodpeckers on the Apalachicola and 47 on the Wakulla.

In 1989 we monitored 40 clans on the Wakulla District and found 27 of them to have breeding pairs. In 1990, we went back to those original 27 and found 21 breeding. This year, to date, out of 43 clans, 35 have breeding pairs. We didn't start banding on the Apalachicola District until last year. We want to use some of those birds for augmentation, to move them around the country as needed. We monitored 97 clans in 1990 and 132 this year. Chuck Hess had 84 of 97 clans breed last year on the Apalachicola District and 108 so far this year out of the 132, and that number probably will go up.

The birds are laying an average of between 3 and 4 eggs per nest, hatching an average of about 2, and fledging an average of between 0.90 and 1.31 birds. "3, 2, 1," is the way we look at it. This result shows you the progression of loss due to infertility in eggs and other such things.

I didn't join this business because I wanted to take care of woodpeckers. When I began work in the Kisatchie National Forest in May 1985, the ranger told me to get out in the woods and find all the woodpecker trees, because we had a Sierra Club lawsuit going on. Since then I've experienced a lot. I've dealt with academicians, research folks, and military folks. I didn't see much cooperation in 1985, but now I see it more and more. I think it was obvious at the "summit" meeting that Fran referred to. We're getting a lot of constituent input from environmental organizations, sometimes through legal council and the media. The Forest Service lost the court case in Texas. Now, military bases are beginning to be subjected to some of that, but they're trying to keep ahead of it.

The Forest Service is changing dramatically, as Ron has already told you. We've gone from a handbook to an emergency policy to interim guidelines, and now we're developing plans for the proposed long-term strategy. A lot has happened in the last five years.

We have to use common sense and put our combined expertise together, not just woodpecker expertise, but silvicultural expertise, ecology, and the rest. Now that we're cooperating, let's not lose our momentum; we might lose it all. Let's not slow down; let's keep moving on. Thanks.

Fran James:

Unfortunately, even though the Forest Service is doing better every year with monitoring and changing in response to the needs of the Red-cockaded Woodpecker, we are still losing the battle. That 17% drop on the Wakulla District of the Apalachicola National Forest is typical. The median loss in the last decade on all sites that we know about is about a 26% loss. So this really is an emergency. The answer, if we're going to pull it out, is to plan way ahead. For example, the birds need cavity trees that are close to 100 years old, and the present ones are dying at 1-5% a year. We need a combination of long-term management and imaginative stopgap techniques.

Jeff Walters:

I want to talk about woodpecker management and what it can be expected to accomplish, but for that to make any sense, I first have to give some background about population dynamics, so you can see why the application of different techniques will have different results.

Research that Phil Doerr, Jay Carter and I, and our many students and technicians have done at the North Carolina State University over several years has led me to believe that the Red-cockaded Woodpecker has a highly unusual breeding system, different from that of any other bird in the longleaf pine system--in fact different from that of any other bird in the Southeast, except for the Florida Scrub Jay, which is also declining, as you probably know. It's no coincidence that both of these species are sensitive to habitat change. The unusual aspects of their population dynamics are very important to management. Red-cockaded Woodpeckers are cooperative breeders. Some young male birds disperse after they've fledged to find a place to settle and breed on their own as is typical of bird species, but many males instead remain as "helpers." They stay on the natal territory with their parents, and they help care for subsequent broods of offspring, which often are their younger siblings. Why do they stay at home? Maybe somebody in the audience has a 25-year-old son who's still living at home. Is he living at home because he wants to help you take care of his younger sister? Probably not!

The male Red-cockaded Woodpeckers are not staying at home to do this helping, either. They're staying at home because the opportunities for them to leave and become a breeder, the opportunities for them to go out on their own, are limited, more than in other birds, and they're waiting for their opportunity. They're simply trying to become breeders, but in a different way. How do helpers become breeders? If you're a helper in year one, you may still be a helper at year two. We've had helpers 8 years old, helpers still with Mom and Dad. Some of them die, but they can also become breeders because they can inherit the natal territory when Dad dies. Even those that disperse go literally right next door--65% of them to a neighboring territory. Some go a little farther, but none go very far. So they're sitting at home waiting, monitoring vacancies in their vicinity. They're in a good position to take a vacancy as soon as it arises. The ones that leave right after they fledge go much farther. In fact, they go farther than do females, almost all of whom leave right after fledging and search for an opening. And many of those males go much farther than two territories away.

So some of the young males disperse, and they may find a territory and a mate at age one and start breeding, but a lot of them don't. A lot of them end up as solitary males. This is the biggest source of solitary males in our population and many others. They get territories, but no mates. Twenty-five percent end up as floaters--they don't get either a territory or a mate at age one. They're still wandering around looking. This is a very high number compared to other kinds of birds. Why do they have such a hard time? My view is that it all has to do with the fact that they make cavities in live pines. Most woodpeckers make cavities in dead limbs. They can make a cavity in a few weeks or months. It takes a Red-cockaded Woodpecker many, many months at a minimum, typically years, to make a new cavity. And to make a long story short, it's so hard to go out and make new cavities and start a new territory that an individual is better off waiting for an opening on an existing territory that already has cavities. So, the worst territory in the worst habitat that already has cavities is better than the very best territory in the best habitat that doesn't have cavities already. The individual is better off waiting, even if it means delaying reproduction for two or three years, to take an existing territory with cavities already on it, than to go out and construct new ones. Therefore, what you see in Red-cockaded Woodpecker is turnover of individuals at existing clusters of cavity trees--filling openings in those clusters; you rarely see new sets of cavities being constructed.

Now, if what I'm saying is true, then there ought to be plenty of unoccupied areas out there that are perfectly good for woodpeckers except

they don't have cavities. You ought to be able, by constructing cavities, to turn those unacceptable sites into acceptable ones, literally overnight, by adding artificial cavities, which we did a couple of years ago. We tried this in both what we call vacant areas--areas that have had no old cavities and no woodpeckers for at least a couple of decades--and areas with abandoned sites, mostly ones that had been abandoned for quite some time. We also cleared understory around potential cavity trees, but we did that in control areas, as well. So we had control areas where we cleared out all the understory, and then we had experimental areas where we cleared out all the understory, plus added the cavities. We had 20 of each. In the first breeding season, 18 out of 20 experimental areas were occupied. None of the 20 control sites, with just understory clearing, were occupied.

So, we have some good evidence that cavities are limited and that adding cavities helps. What does this mean for population dynamics? For most birds, population size would be a fairly simple function of survival and reproduction. These, of course, would be affected by habitat quality--if you do something to improve the quality of the habitat, you get better reproduction, you get better survival, and your population will grow. This is not quite true with Red-cockaded Woodpeckers. You also have to worry about how many acceptable territories you have out there--how many territories with cavities you have. If you do something that improves reproduction and survival of the birds, you will get a bigger population. But what you will get is more floaters and more helpers. You'll get bigger average group (clan) size; you won't get any more groups in your population. That's what's unusual about Red-cockaded Woodpeckers. You have to do other things to increase the number of groups, at least with any speed. You could wait for them to do it themselves. They do occasionally make new groups. For every 200 existing groups you can expect one new group per year. Mostly new groups arise by splitting of an existing set of cavities--somebody splits off, a helper or a floater comes in, takes over one or two cavities and constructs some of its own, and one territory splits into two. But it's a very slow process. So, you can't expect to do something that improves the reproduction of the woodpecker and see your population dramatically increase in any reasonable period of time.

What about population declines? Declines could come about for two reasons. They could come about because survival and reproduction are adversely affected by something--that's what you would normally expect to see in most birds--because good territories are being lost. My reading of the evidence is that, in the overwhelming majority of cases with the Red-cockaded Woodpecker, it's because territories are being lost. In most populations, reproduction and survival continue to be perfectly normal as the population goes down. That may seem counterintuitive, but that's what happens. Decline is accompanied by territory abandonment. Previously suitable territories become unsuitable, and I think that has mostly to do with cavities. So if you're going to do effective management, you have to know what your management technique is going to affect, and you have to know what your problem in that population really is. Is it reproduction and survival, or is it the number of acceptable territories? If it's the latter, you have to keep existing territories acceptable, and you have to turn unoccupied, unacceptable territories into acceptable ones.

Now let me get to management and techniques. Start with fire, certainly the most suitable technique for this conference. Many management techniques affect woodpeckers specifically and they don't really affect much about the total system. Others affect the total system in drastic, important ways. Fire, of course, is one of the latter. What it does for woodpeckers is remove understory, and one important reason that woodpeckers abandon territories is that understory encroaches on the cavities and makes them unacceptable. So, prescribed burning is a management technique that can keep suitable territories acceptable.

You could say the same thing about converting to longleaf pine. Longleaf is the preferred pine for the woodpecker, and Dick Conner's and Craig Rudolph's work in Texas is indicating that the preference has to do with the unusual resin flow in longleaf. The birds make wells around their cavities to protect themselves from predators, primarily snakes, that could otherwise climb to the cavity easily. Typically, a longleaf pine will keep pumping resin out of those resin wells for a very long time. Loblolly will not. Loblolly will pump for a few years and then stop, at which point the cavity ceases to be a good one. So, there's a very high turnover in cavities in loblolly. It's hard for the birds to keep up. In longleaf they can use the same cavity for a very long time.

Other understory-removal techniques can do the same thing as fire. They'll have different effects on the ground cover than fire does, but for the woodpecker, they do the same thing. They can keep suitable territories suitable. Fire and under-

story removal won't do everything, though. They won't induce birds to move back into an abandoned territory that's been abandoned for a long time, if the cavities have deteriorated. If there haven't been any birds in there for 20 years, the cavities are probably rotted--they're probably no good--and just clearing the understory isn't going to add a new group to the population.

In the same way, you can't expect areas that are vacant, that birds are not using now and haven't at any time in recent history, and that have no old cavities, suddenly to become occupied because the area's been burned. They're still not acceptable territories. Everything else may be good, but there still are no cavities there. That's where artificial cavities come in. If you have good habitat, you should be able to add cavities to it and get the birds in there literally overnight or fairly close to it. A lot of these management techniques haven't been used for long on a large scale, but what has happened so far seems to support my view. Understory removal alone has seldom, if ever, led to rapid increases in populations. Neither has burning alone. On the other hand, the response to cavity construction has been consistently good and has been monitored in several places now. The most dramatic example is on the Francis Marion National Forest--the effort led by Bob Hooper--where, in 1989, 90% of the cavity trees and 60% of the birds were lost in Hurricane Hugo. At the end of the storm, there were more birds than cavities, and in my view, what would then have happened is the remaining birds would have competed for the existing cavities, and more territories would have been abandoned because there weren't any cavities left on them. Bob and his crew put cavities there, and today 65% of the territories are still occupied. Many of these occupations are by single birds. This is what you'd expect. The storm did have a dramatic effect on survival. So, the group size is smaller; now you have many groups of one, some groups of two, and there are all kinds of vacancies out there. All the helpers and floaters have filled vacancies. Given some good reproduction, which seems to be occurring, the birds should be able to fill in those vacancies in just a few years. You're much better off to have 200 groups with 1.5 individuals, on the average, in each, than to have 60 groups with five birds in each. In the first case, it would only take a few years, maybe three years, to get back to 200 breeding groups, whereas at the rate that it happens in our population, to get from 60 back up to 200 groups with all these nonbreeders around would take about 300 years.

I'm saying protecting cavity trees and providing new trees for birds to put replacement cavities in is crucial to keeping habitat acceptable. Another method you may know about is cavity restrictors or excluders, which are little metal plates put around cavity entrances to keep larger species from stealing the cavities from Red-cockaded Woodpeckers and enlarging them. There are a few species that steal them despite excluders because they're the same size as the woodpeckers.

The effectiveness of trying to control other species depends on what those other species do. If all they do is take over the cavity they are a serious problem only if the problem is reproduction--that is, if you have open slots on good territories and not enough birds to fill them. If the limiting factor is acceptable territories, controlling the invading species won't increase the number of groups in the population. You have plenty of birds for the acceptable slots, so a reduction in reproduction caused by, say flying squirrels, doesn't really change the number of groups out there. On the other hand, species like Pilieated Woodpeckers, which completely destroy a cavity--just bash it to bits--can make an acceptable territory into an unacceptable one in a matter of days. So, if the problem is that you don't have enough acceptable territories on your land, then you want to use restrictors to keep Pileated Woodpeckers away from those cavities.

The final factor I'll mention is foraging habitat. Probably the best way to improve reproduction and survival is to improve the foraging habitat. There's some good evidence that the quality and quantity of foraging habitat is related to reproduction by the group on that territory. There's not so much evidence for survival, but that's pretty likely. On the other hand, there has to be some minimum level of foraging habitat below which a territory is unacceptable. Generally where we have declines, at least in recent times, foraging habitat has not been the problem. Territories are not getting abandoned because of lack of foraging habitat in the few places where we can really look at those things. Instead, it more often has to do with increasing understory or problems with the cavities. So, again, if your problem is not enough suitable territories, you can't expect that improving the foraging habitat will solve that problem. If the problem is not enough birds to fill available slots, you can expect it to solve that.

Finally, it's my opinion, and I guess I've heard several other people say the same thing, that we know enough now about Red-cockaded Woodpeckers that we can bring them back to whatever

level we want. I'm convinced it can be done, that we have the ability to recover populations. The big question, and what makes it very exciting to work with Red-cockaded Woodpeckers, is, do we have the will in our society to do this? What are our priorities? What sacrifices are we willing to make? We can measure exactly what the effects will be. That's why I think it's perfectly appropriate that a lot of the legal precedent is set on Red-cockaded Woodpeckers. I think it may be the best species on which to break legal ground, because we have a lot of knowledge of biology, we can make some clear statements about what the cost and benefits of different possibilities are.

Fran James:

Thanks, Jeff. I think we should now take questions from the audience.

Audience Member #1:

I have a comment I would like to make from an ecological perspective about Red-cockaded Woodpecker management. First of all, I believe that management of the Red-cockaded Woodpecker can be used to maintain the longleaf ecosystem. Unfortunately, in my experience in Texas, management strategies that were recommended in the court case were used to justify damaging some old-growth stands of longleaf. They were used to justify digging trench lines around cavity trees, which eventually led to the death of those cavity trees. And there are other examples. I want to caution people about using Red-cockaded Woodpecker management. Although I believe it's important for us to impose some rather drastic measures, I wish people would try to incorporate Red-cockaded Woodpecker management into an ecosystem type of approach. I would like to see the Forest Service emphasize this more, rather than their single-species approach.

Ron Escano:

I wholeheartedly agree with your basic premise. Some of the things you describe are why the Forest Service lost the court case in Texas.

Audience Member #2:

If the birds really would prefer longleaf because longleaf continues to exude sap and the other pine species do not, to what do you attribute the fact that colonies exist outside the geographic range of longleaf? Why would they continue to nest in shortleaf or loblolly if they really don't like it?

Jeff Walters:

As long as the birds can keep replacing their cavities at a fast enough rate to make up for cavity loss, they can continue to use those pine species, but I suspect that the extinction rate in those pines is higher than in longleaf. I think that is because more groups are unable to keep up; they can't find enough replacement cavity trees. If plenty of replacement cavity trees were available, they could continue indefinitely. If not, they have a problem. What Dick Conner has shown in Texas is exactly that. There is a problem with replacement rate. The colonies that disappear often do so because they don't keep up.

Audience Member #2:

Why did the birds go into these habitats to start with?

Jeff Walters:

Because historically there would have been no problem with replacement cavity trees. There would have been plenty of old trees for them to use. It probably wasn't their best habitat, but it was habitat that they could exist in. It's more difficult now, I think, than it was then.

Ron Escano:

Currently in Kentucky, the population is dependent upon Virginia pine. It's a very short-lived tree. Basically that's all that is available to the birds. Historically, they probably were dependent upon shortleaf pine, which is a good potential cavity tree. It has characteristics similar to that of longleaf. Long-term survival of Red-cockadeds in the northern periphery of their range will be dependent upon Virginia pine as a stopgap, but not permanently.

Audience Member #3:

Just a comment. In talking with Ralph, it seemed the Apalachicola National Forest is broken

down into longleaf pine and slash pine. It's my impression from Dan Fields that most of those stands are classified as slash pine, and I think anything up to 51% slash and 49% longleaf is subject to slash pine management.

Ralph Costa:

Yes, the Forest Service tallies slash pine separately from longleaf pine. The stands commonly are mixed longleaf and slash pine. It's a record-keeping problem. We don't recognize mixed pine stands, and we don't have any way to record them. Our inventory system says it's either slash pine or longleaf pine, and furthermore it'll be managed as either slash pine or longleaf pine.

Audience Member #3:

Can we change that, starting now?

Ralph Costa:

Well, I can give you a couple of phone numbers. I would like to change it. We talk about it all the time. We didn't recognize mixed stands as viable management sites until very recently. We recognized it on the ground. We called it pine-oak, but it was going to be oak or pine when we were finished.

Ron Escano:

I'd like to comment on this point. A lot of effort to determine the potential for longleaf is based on looking at soil characteristics to determine site potential and using site potential to determine management types. The next round of planning with GIS will help us map where longleaf will grow, and that will guide management.

Audience Member #4:

We tend to think in black-and-white terms of even-age versus uneven-age management, but there are alternative systems to that. There have been many variations on the four major silvicultural systems that are used in managed forests. You made the point that you are shifting to a 100-, 120-, and 200-year rotation, I assume for shelterwood or even age. There's also a system that was developed in Europe called the deferred harvest. It was developed in Germany in the 18th century and has been tried in the Appalachian hardwoods by Clay Smith, who is a Forest Service silviculturalist. He's had some very positive results. Rather than creating even-age or uneven-age structure with stands, it creates a modified multistoried canopy. It's also referred to by some ecologists as overwood retention. It forgoes the removal cut in a standard shelterwood operation. The overwood is retained on site, and you can conceive of this being done on, let's say, a 75-year rotation. You would have, at any point in time, large full trees on the site continuously, which provide a continuous canopy cover, so you never have a horizon-to-horizon-clear situation, as you have following the overwood removal. You always have large, old trees. They're the most prolific seed producers. They are also potential cavity trees, and they provide a moderate sweep of shade as the sun arcs through the sky. They affect microclimate, and they prevent some of the disease problems that can result with single-tree selection systems. My point is that there are many potential tools in the bag, and I believe that the Forest Service is trying to move in that direction.

Some of my colleagues are developing research for some density-specific analyses in this type of system to see if it is truly workable in the coastal plain. There was a fellow in the 1940s with the University of Florida, who actually advocated use of this system, specifically in longleaf pine. I guess I was surprised when I moved to this part of the country that folks seem to have forgotten that he said this 50 years ago. Joan Walker reminded me of that.

Audience Member #5:

Back in 1957, on an experimental forest, we cut several stands to arrange their density, primarily to determine what seed production would be. We had 9, 18, 27, 36, and 45 square feet of basal area. We've remeasured these same stands of known age class, known residual densities, and we know exactly what our data class distributions are, volumes, the whole works. That's at age 35.

Ron Escano:

I'd like to comment on that. What you've basically described is the system that's currently in place in the interim guidelines. You're describing a shelterwood technique. In the long-term strat-

egy, that is an element of what's being proposed. The amount of overwood and how you retain it varies by the forest type.

Fran James:

Ron, how available is your long-term strategy to people here in the audience. Could they obtain copies?

Ron Escano:

Probably not. It's been sent out for internal review and to the participants of the summit but is not available to the general public. If you have a burning desire to look at it, you could request it from Joe Dabney, the team leader in Atlanta. It will be available for review by the public when the formal review process starts.

Fran James:

So there will be plenty of opportunity to comment on it?

Ron Escano:

Yes.

Audience Member #6:

I have a question for Jeff and Ralph about augmentation. In the North Carolina population, 56% of the female fledglings go off and die, and the augmentation project is based on the idea that it's OK to draw from those, because they are going to die anyway. I'd like to ask Jeff what his impressions are. Is the basis for that sound? Also, are there plans to do follow-up research to see if removing females is having any effect on the clans that you're taking them from in the Apalachicola Ranger District?

Ralph Costa:

The Forest Service got into augmentation because of exactly what you said. We recognize, partly because of Jeff's data, that there are excess birds that we can turn into breeders. We can almost guarantee that a certain percentage of them will breed that first year. We've only been doing this two years; it's a new database.

Jeff Walters:

We don't have a lot of data on when fledglings die, but it appears that they start dying very soon after they're out of the cavity and continue all through the winter. Mortality is spread out. If you took birds in March, after they've survived the winter period, then that would have the maximum effect on the source population, because those are the individuals that are going to make it and fill in breeding vacancies. We found that a lot of the females that became breeders at age one by dispersing were still with their natal clans in February and March, even into April. They don't move until very late. If you wanted to minimize the effect on the source population, you would take birds early. You'd take them in July and August when they first start to disperse out. Those birds probably are the ones that have the highest mortality, those that leave early. The other side of that is that they have to survive the winter in their new place. So taking birds early is going to be the least effective from the viewpoint of the population that's receiving the birds, but it's also the least damaging to the donor population.

Ralph Costa:

We don't just grab a bird and ship it to another state. Acceptable cavities must be set up and ready to go. There must be habitat for foraging. It's checked rigorously. For populations in the DeSoto National Forest or the Homochitto where there were fewer than five clans left and three or four were single birds, we've managed to turn them into four or five breeding pairs. It's a short-term survival strategy to keep a small population in existence, and now we have a new capability, tested by Conner and others in Texas, to move a male and female from different clusters, make cavities for them at a new site, put them in their new habitat, and create a new breeding unit. Initially, augmentation was bringing a young female to the territory of a single male. Now Conner has been successful in moving two individual birds and creating a new clan.

Ron Escano:

These two strategies, augmentation and artificial cavities, are the major breakthroughs in man-

agement of the species. In the last two years we have augmented 30-35 clans, with about 60% success; success is defined as a pairbond, the successful pairing of the added individual. We now have the capability to restore populations and to reestablish populations in places where the birds disappeared.

Fran James:

I'm sorry but we are out of time. Thank you, panelists. And thank you to the audience for your lively participation.