

TRANSCRIPT

INTERVIEWEE: Craig Rudolph, Ph.D.

INTERVIEWER: David Todd

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Google Voice [00:00:01] This call is now being recorded.

David Todd [00:00:05] Yeah, so I would just want to ask you if there was some book or movie or other kind of cultural piece that was, you know, significant and influential for you in your career.

Craig Rudolph [00:00:20] Perhaps not in the in the sense I think you're asking that question, but there was one book in particular that stands out, and this is a book in the field of biology. It was "The Theory of Island Biogeography", published in 1967, when I was an undergraduate at University of California. And it was written by Robert Parker and E.O. Wilson, who were icons in the ecological literature at that period in time. And it helped me realize the overwhelming importance of habitat fragmentation in the extirpation of individual populations and, ultimately, the extinction of species. And MacArthur and Wilson explored their ideas using islands as case study. But it was immediately obvious, I think, to many in the field that these ideas applied equally well across the globe, even up to continental scale. And I think habitat fragmentation represents the major issue, perhaps along with climate change, facing conservation efforts.

Craig Rudolph [00:01:28] And its effects, the effects of habitat fragmentation, are really under-appreciated, even when the effects are appreciated scientifically, on the ground. Conservation measures to address the problem are very often grossly inadequate, largely, I think, because the solutions are so intractable. And unfortunately, conservation measures that are implemented are often necessary to control this problem, but they're really not sufficient. And I think that remains a big issue in the field of conservation.

David Todd [00:02:12] So the point here, I guess, is that a lot of these problems are, are not peculiar to an acre, or 10 acres, or a thousand, or even a hundred thousand, but that they can be in and over really big ecosystems and immense landscapes.

Craig Rudolph [00:02:30] Yeah, I mean, scale matters so much in, in ecological and evolutionary terms that it's just expensive and requires an enormous land base to preserve viable fragments of the original ecosystem and all the species involved. So, a difficult problem.

David Todd [00:03:00] Yeah, yeah. Well, I think this gives a good idea from your childhood through your grade school, and college, grad school education to sort of what was preparing you. Now, I was hoping that you could talk a little bit about how you came on with this job that you held for, for, gosh, nearly a generation, working at the Southern Research Station, part of the research branch of the U.S. Forest Service, as an ecologist there. How did you come to find that position and get on with the Forest Service?

Craig Rudolph [00:03:44] Well, it was really through a bit of serendipity, or perhaps more accurately, an enormous amount of serendipity. I was living in Nacogdoches at the time, Nacogdoches, Texas, which is in the eastern part of the state. And I was finishing writing my dissertation. And I was aware that Dick Conner was a research scientist at the Southern Research Station lab in Nacogdoches and was involved in red-cockaded woodpecker work. I was vaguely aware of the very interesting biology of the red-cockaded woodpecker and the conservation issues involved. So I went to visit the lab and talked with Dick. And at the time, he had recently become involved in a census of red-cockaded woodpeckers on one of the national forests in Texas. And that discussion eventually led to my becoming involved in that work, first as a volunteer. Eventually I was a temporary employee, then what's in the Forest Service considered a "term employee", and after a number of years, as a permanent employee, as a scientist.

Craig Rudolph [00:04:52] And Dick Conner and I eventually focused much of our work on red-cockaded woodpecker biology and conservation. And this, for me, proved to be a very satisfying career path, combining my interest in ornithology, conservation and fire ecology.

David Todd [00:05:12] So can you give me an idea of what some of your typical tasks would have been? Were you mostly in the field, or did you do, you know, work in the lab, or were you doing a lot of written research? What was the sort of scope and focus of your work?

Craig Rudolph [00:05:32] Yeah, it was mostly field work and then the resulting analysis and writing of manuscripts. There wasn't a lot of lab work in this particular research endeavor, which, which fit my desires pretty closely. I much preferred to be in the field, so I was very happy with that.

David Todd [00:05:56] Well, as you said, Dick Conner brought you onto, in this, this partnership increasingly focused on the red-cockaded woodpecker and its interesting ecology, and biology, and its restoration. And I was hoping that you could talk a little bit about, you know, its association with pines, and its unique social system, and then the tie with the fire regime in those pines. Can you talk a little bit about that?

Craig Rudolph [00:06:34] Yes, absolutely. I probably ought to add, or I certainly should add, that going back to the previous question, that, that we also had a revolving number of very capable assistants in the lab that, that helped us immensely over the years. So it wasn't just Dick and I doing this. There's lots of people were involved, and at other institutions as well, so it was a very cooperative effort. And that actually, I think, made it much more fruitful.

Craig Rudolph [00:07:08] Anyway, back to your question about the association with living pines, social system and so forth.

Craig Rudolph [00:07:20] It's a very interesting situation. Because red-cockaded woodpeckers evolved in the fire-maintained pine pine forests of the southeastern U.S. And around the end of the last great continental glaciation, the changing climate became more conducive to frequent fires. Native Americans arrived in the region about that time and further influenced the fire regime, although I suspect that frequent lightning remained a major source of ignition. And Native American hunting also initiated Pleistocene overkill, resulting in the extinction of much of the large mammalian fauna - the mammoths, the giant ground sloths and so forth.

Craig Rudolph [00:08:01] And the result was major ecological change during the last ten, fifteen thousand years or so. And more importantly, the fire-maintained pine forest rapidly spread during this time from a small area centered on the coastal plain of southern Georgia and northern Florida, and perhaps also in northern Mexico, and expanded to cover much of the southeastern U.S. And the red-cockaded woodpecker moved and evolved with this expansion.

Craig Rudolph [00:08:31] And the resulting ecosystem was, in large part, a vast pine forest with a largely herbaceous understory with many characteristics of prairie vegetation. And frequent, low intensity fires that would burn through the herbaceous vegetation allowed the mature trees to survive in most instances. So even though fire return intervals might be three, five, maybe 10 years, in some cases, some of the individual trees could survive many of those fires and live to be well in excess of 100 years of age. So it was quite an interesting ecosystem. And...

David Todd [00:09:20] You know.

Craig Rudolph [00:09:20] I'm sorry, go ahead.

David Todd [00:09:21] Well, no, I just thought it was really interesting, something that you said, and I didn't want to let it pass, if you don't mind. I think you talked a little bit about the role of the Native Americans in manipulating this ecosystem. Some of this fire was, I guess, natural from lightning, as you pointed out, but, but you think that there was also a role for Native Americans. Why were they setting fires? You know, what do you think the impact of those fires that were set up by man?

Craig Rudolph [00:09:57] Well, there's not a whole lot known about this. Or at least I'm not aware of a whole lot of detailed information. But it's well known at the time of European contact that Native Americans set a lot of fires, not just in the Southeast, but throughout much of the continent. And they did it for a variety of reasons - to open up the landscape a bit, make travel easier, improve habitat for prey species that they were then taking advantage of. So there were many reasons that Native Americans would use fire.

Craig Rudolph [00:10:34] And, especially in the southeastern U.S., since lightning is such a part of the whole ecosystem, it's kind of hard to say how much additional influence the Native Americans had. There would have been so much fire anyway, it's just almost unknowable - you know, whether the presence of Native Americans really changed the fire return interval substantially or not, so.

David Todd [00:11:07] Okay, that's helpful, thank you very much.

Craig Rudolph [00:11:12] Well, then I was going to go on say that, a little bit about the ecology of red-cockaded woodpeckers. Most woodpecker species excavate their nest cavities in dead wood, either a dead or dying tree, or a dead limb on an otherwise living tree and so forth. But that has a number of advantages. Once that wood, once it dies, begins to decay, and that softens the wood a bit so the woodpeckers have an easier task of excavating a cavity, because the wood has been variously softened by fungal decay.

Craig Rudolph [00:11:54] The frequent fires of the southeastern pine forest reduced the amount of dead wood available: dead trees would burn up in subsequent fires. It's hypothesized that this situation - abundant foraging habitat and the limited substrate for

cavity excavation because all the dead trees are being burned up - led to the evolution of behaviors of red-cockaded woodpeckers.

Craig Rudolph [00:12:19] And they evolved, eventually, to exclusively use the trunk of living pines for cavity excavation - a pretty unusual situation in woodpeckers in general. And then this necessitated excavation in found wood, living tissue, in the absence of significant fungal decay. Although the choice of living pine infected with red heart fungus, which decays the heart wood, not the sap wood, significantly solves that problem. They could then, once they got through sapwood, the living tissue, and got into the heart wood, it could be decayed by this red heart fungal decay. And then the rest of the cavity could be rather rapidly excavated.

Craig Rudolph [00:13:11] But nonetheless, excavating a cavity in a living tree is a substantial and laborious task, and it often takes several years for a group, a social group of woodpeckers, to excavate a given cavity. You know, they'll work on it pretty much every day. But then in the sapwood, the tree is producing sap to try to heal the wounds, and they've got to wait for the sap to harden and then go back to working on the cavity again. So it can be a long process.

Craig Rudolph [00:13:49] So completed cavities thus represent an extremely valuable resource for the woodpeckers and affects their overall biology. So we further hypothesized that the extreme value of these cavities resulted in the evolution of the complex social behavior of red-cockaded woodpeckers, and it was an evolutionary advantage to fledged young, especially the males, to remain in the territory of their parents, and they assisted in many ways in raising subsequent broods. But the expectation was that those males would then inherit those cavities, those very valuable cavities, on the death of the breeding male - most often it would be their father.

Craig Rudolph [00:14:36] And this ultimately led to all the complexities of the cooperative breeding situation that now exists in red-cockaded woodpeckers. And in essence, cooperative breeding was a consequence of the extreme value cavities that they took so long to excavate, which was in turn a consequence of the adaptations of living in a fire-maintained ecosystem where dead wood was at a premium - dead trees to excavate cavities. So it's quite an unusual and elegant system.

David Todd [00:15:13] It's funny, it makes me think of, of these, you know, very sort of complicated aristocratic systems of preserving and passing on title to lands.

Craig Rudolph [00:15:27] Yeah, exactly.

David Todd [00:15:28] And among people.

Craig Rudolph [00:15:36] I'd never put it in those terms, but you're correct.

David Todd [00:15:40] Well, I guess this is sort of anthropocentric to think that way, but it is the thing that occurs to me.

Craig Rudolph [00:15:48] Not entirely.

David Todd [00:15:50] Well, evidently, I mean, I guess the red-cockaded woodpeckers have, you know, managed to do this sort of dynastic control of these cavities, that's really fascinating.

David Todd [00:16:00] Well, so you know, it's interesting that these, these birds, which had been so dominant for thousands of years, then started to decline. And I was wondering if you could help us understand how that decline started and what some of the factors might have been.

Craig Rudolph [00:16:23] Well, it's some of the usual culprits in decline of species of various types. And habitat loss due to loss of forests to agriculture and urban urbanization was obviously an important factor. But given that forested habitat remained, and remains to this day, relatively abundant in the historical range of red-cockaded woodpeckers, the current forests are usually not suitable for the woodpeckers. The restriction of cavity excavation to living pine, ideally with substantial red heart fungus, requires really relatively old and large trees - generally 100 years or more of age. So these trees provide the large diameter of hardwood to allow the cavity chamber to be excavated entirely in the heart wood and thus remain free of resin coming in from the sap wood, which can cause problems, sometimes fatal problems, for the woodpeckers. Resin sap is very viscous.

Craig Rudolph [00:17:34] So the wave of harvesting which progressed across the South and culminated in Texas in the early 1900s removed essentially all of these old large trees with devastating impacts on the red-cockaded woodpecker population. Subsequent silvicultural practices, including clear cutting, conversion of longleaf pines to loblolly pine, short rotations, and so forth, precluded the regeneration of suitable old red heart infested trees on a fairly large scale on the landscape. So that was another problem.

Craig Rudolph [00:18:12] In addition, to nearly, and this is really, I think, crucial as well - the nearly ubiquitous and aggressive fire suppression over the last hundred years or so. All of the original open pine forests with herbaceous understory, the forests with very dense midstory and shrubby understory. And this occurred even in the limited areas set aside to preserve examples of old growth forests. Areas were set aside as wilderness and so forth, but they weren't burned. In fact, they were protected from fire, and that caused basically a succession toward hardwood. So, there became fewer and fewer forests, even though, in aggregate, there was lots of forest land. It just wasn't suitable for red-cockaded woodpeckers.

Craig Rudolph [00:19:04] So these factors led to a tremendous increase in habitat fragmentation, with all the resulting genetic and demographic consequences that put the red-cockaded woodpecker on a path to extinction and that's, you know, where the situation stood in 1980, more or less.

David Todd [00:19:23] Okay. Well, I had a couple of follow-up questions, if you don't mind. You mentioned something that I really hadn't thought about before, and I was hoping you could sort of maybe fill in the gaps, at least in my mind. And that is that the, this red heart fungus not only made the wood soft enough to excavate and create a cavity, but, and this is the thing I missed, that there was no sap or resin coming out of that that might have harmed the birds. Is that, is that, am I understanding that right?

Craig Rudolph [00:20:02] Yes. Yes, the, the, I mean, if you think of a cross-section of a tree, you've got the living sap wood around the outside, just inside the bark, and it can be of varying thickness, up to, you know, several inches. And then inside, it's just the core of what's called heartwood, which is basically old dead sapwood that no longer transports resin. So it's basically pretty dry in there, the heartwood is.

Craig Rudolph [00:20:33] So once the woodpecker makes the horizontal, excavates the horizontal entrance to, into the bole of the pine, gets into that heartwood, then it can turn down and start excavating the chamber where it's going to lay eggs, and raise the nestlings, and roost, and these other activities, and that wood is not going to transport resin into the cavity itself. Part of the cavity, in fact, is going to be occupied by the, by the bird.

Craig Rudolph [00:21:08] And it even goes beyond that because the entrance too is sloped ever so slightly upward so that resin that's being transported into that tube as it's being excavated, will run toward the exterior, the exterior of the tree and flow down the bole of the tree out of the way. And won't flow back into where the bird's going to be excavating the chamber. And then eventually the resin's going to crystallize and dry and will no longer be viscous and a problem for the woodpeckers. So then they'll have this very secure cavity in really sound wood, so it's hard for a predator to breach that entrance tube and enlarge it and get in there and predate the young and so forth. So it's a very neat evolutionary solution to what would otherwise be really an intractable problem. But the burden of years to excavate a cavity.

David Todd [00:22:13] Right. Right. So one of the things that that I heard you say, which I thought was really interesting, was that, you know, some of the changes in forest management, you know, affected the bird. And typically I would think, well, it's, it's too much clear-cutting and the rotations are too short, or, you know, the species are wrong.

Craig Rudolph [00:22:40] It's all of it.

David Todd [00:22:40] But then, then you mentioned something that I hadn't focus on, but just the sheer protection of lands as wilderness might have slowed people from doing the kind of aggressive management like, you know, instituting fire.

Craig Rudolph [00:22:56] Yeah.

David Todd [00:22:57] Is that true? Is that what you were trying to say there?

Craig Rudolph [00:23:00] Yeah, absolutely. But that that's kind of almost beside the point, because there's so little land in the southeastern U.S. that's managed as wilderness area. I mean, it's infinitesimal, really, it wouldn't, it didn't make much of a contribution to the recovery of the red-cockaded woodpecker, compared to in the West, where we have, relatively speaking, large areas of wilderness. That's simply not true in the South, primarily because there's so little public land in the South to host a wilderness area.

Craig Rudolph [00:23:45] And even the national forests that occur in the South, if you actually look, not at the big green blobs on a highway map, but if you look at the actual ownership, there are so many in-holdings, you know, within that general outline of the national forests, that often half or more of the forest is really not public land. It's private in-holdings within the forest. So there's just not as much public land to work with as far as that wilderness areas, and so forth.

David Todd [00:24:19] Okay. That is really helpful. I appreciate it. And then last the thing I think I heard you say was that this habitat fragmentation isolated a bunch of the red-cockaded woodpeckers, I guess the individuals and the colonies, and had genetic consequences, and I was wondering if that's what you're aiming to say was that these birds went through some sort of genetic bottleneck and that there might have been inbreeding problems, and the like.

Craig Rudolph [00:24:50] That was, that was a concern early on. But, it turned out not to be a major factor. I mean, there were, as I recall the research, and I was not involved in this, but as I recall, some of the research that went on looking at, for evidence of genetic bottlenecks, and decline in genetic diversity, and so forth, was, was really quite minimal.

Craig Rudolph [00:25:17] But, and that's partly a consequence that when the species was listed as endangered, and I believe in '73, 1973, there were still thousands of red-cockaded woodpeckers in existence. It was actually listed with many more individuals still living than many species that were subsequently listed, where we were down often to, you know, a few hundred or something.

Craig Rudolph [00:25:51] So there was still a fair bit, and some large populations, so genetic diversity was still quite adequate. It really wasn't that much of a problem. Not to say it didn't need to be addressed going forward. But it wasn't a severe problem at that time.

David Todd [00:26:08] I see. So in a sense, the red-cockaded woodpecker is just sort of a, maybe a case study in the reasons to list a species earlier than later.

Craig Rudolph [00:26:19] Oh, absolutely. Absolutely.

David Todd [00:26:22] Okay.

Craig Rudolph [00:26:24] I did feel at the time, I can just remember feeling, you know, that we were kind of on the brink of losing this species. But in retrospect, there were still quite a few birds to work with.

David Todd [00:26:42] I see. So you told us a little bit about the, the decline of these birds. But then as I understand it, the red-cockaded woodpecker populations in Texas, and I guess across the South and Southeast, began to stabilize and then finally increase in the early 1990s. What do you think was responsible for the reversal in the arc of their populations?

Craig Rudolph [00:27:14] Well, basically, I think this was due to three major factors. One was substantial areas, primarily on national forest land, but other, other ownerships as well, there were changes in forestry practices that ensured the growth and survival of significant numbers of older trees, you know, basically those in excess of 100 years that were suitable for cavity excavation. And this ultimately is crucial. And all of this is a decades-long process that began to get started in the late '80s and '90s and subsequently. So that was one thing, and that's mostly kind of a going-forward type thing.

Craig Rudolph [00:28:01] In addition, there was a return to an ecologically more natural fire regime using prescribed fire. There just wasn't enough wildfire across the landscape and of course, it's difficult in a fairly developed landscape to let wildfires burn uncontrolled, so you really needed to return fire to the ecosystem using prescribed fire. And, for reasons that we'll talk about a bit later in this, this process here, prescribed fire began to be applied more aggressively and more commonly across the landscape. So that got, you know, back to the type of an ecosystem that red-cockaded woodpeckers were evolved, were evolved for - one with basically less midstory vegetation and a rich, herbaceous understory.

Craig Rudolph [00:29:01] And ultimately, as the ecosystem is restored, fires are more frequent but less intense, providing less severe wildfire conditions, management for the species is, is more accepted by those involved landowners, the public and so forth.

Craig Rudolph [00:29:21] And finally, and this is the really critical aspect that I can't overly stress, was the development of techniques for constructing artificial cavities, allowing cavities to be constructed by managers in younger and smaller trees, of which there were an abundance. And so this innovation, pioneered by Carol Copeyon, who is a biologist at North Carolina State University. And she developed an ingenious drilling technique that could construct, drill, a suitable cavity in a living pine, and it didn't have to be particularly large. But that was, that was really an extremely crucial concept to do that. And that opened up just a lot of possibilities in the conservation of the red-cockaded woodpecker.

Craig Rudolph [00:30:26] And David Allen, who is another biologist who worked for the U.S. Forest Service, provided an additional technique to provide artificial cavities, and that was basically to take a nest box and cut a space into the bole of the tree, shove this nest box into the tree and kind of putty it in there and you've got a usable cavity within 30 minutes.

Craig Rudolph [00:30:53] And so those two techniques were, as I said, very crucial in the conservation of the red-cockaded woodpecker.

Craig Rudolph [00:31:07] And that could, for one thing, that could bridge that gap between changes in forestry practices and the decades that it took the younger trees available at that time to grow into old and large enough trees for natural excavation by the woodpeckers of that, kind of bridge that, that gap in there in time. So that was extremely important.

Craig Rudolph [00:31:32] And it also had other benefits. I mean artificial cavities provided the basis for disaster recovery, allowing the rapid replacement of cavities rather than waiting years for the woodpeckers to, to excavate them due to any kind of losses - fires, hurricanes, and so forth. And this was used to great effect in South Carolina, shortly after the development of the artificial cavity technique, following Hurricane Hugo, where one of the largest populations in existence at that time was just devastated by, by the hurricane. And most of their cavity trees were lost. A lot of birds were killed. And artificial cavities got the population stabilized and really back to its pre-hurricane level in just a very few years.

Craig Rudolph [00:32:24] So that was just a remarkable finding that that cavity excavation or cavity construction techniques were available at the time, or just prior to the time, that Hurricane Hugo hit.

Craig Rudolph [00:32:40] And there's some other benefits of artificial cavity construction that we'll, we'll talk about in a moment.

David Todd [00:32:50] OK. You know, something you I think you mentioned as one of the first factors in the recovery of the red-cockaded woodpecker was the fact that, you know, substantial acreage of forests in the Southeast and in Texas had their management approach changed, to I guess allow more older trees to survive. And I think you said that that a lot of these were publicly owned National Forest lands, but I'm curious if there were many participants in this who owned or managed private lands.

Craig Rudolph [00:33:35] There were quite a number. Most of them tended to be small and really probably not viable, just not enough acreage to have a population large enough to

sustain itself without inputs from the outside. But there are a lot of problems with management for an endangered species on private lands, and probably one of the most intractable problems is land ownership.

Craig Rudolph [00:34:10] And it's remarkable as the generations unfold in an area like eastern Texas, for instance, how often the land changes hands. And every time it changes hands, management, land use, vision change, and it's hard to develop a strategy to maintain habitat, especially one that requires, you know, a timeframe of many decades. I mean, you've got to continuously raise one hundred year old plus trees. And if the land's changing hands every 20 or 30 years, that's a problem.

Craig Rudolph [00:34:55] So while there were quite a few private ownerships with woodpeckers on them back in 1980, 1990, in Texas, most of those are now no longer supporting woodpeckers.

Craig Rudolph [00:35:13] So I mean, the future of the red-cockaded woodpecker is on the large tracts of public lands, which are primarily the national forest.

David Todd [00:35:23] OK. Well, that makes sense. So it's not just the fact that it's privately owned, but the fact that the tenure is just too short if you need to plan for 100-year old cycle.

Craig Rudolph [00:35:34] Right, right. You know, what the grandkids want to do with the land is perhaps quite different from what the grandfather wanted to do with the land. So things change and lands get split up.

Craig Rudolph [00:35:49] And, I mean, it's the same issues of maintaining the family farm. It's exactly the same types of issues with generational change.

David Todd [00:36:05] Something else that sort of caught my ear. You were saying that one of the factors for the woodpecker's recovery is the return to a more natural fire regime. And I was kind of struck when you said that part of the, the reason that they are, are on an upswing is that the, you know, with fire being gradually introduced over the years, these more recent fires are less intense, and aggressive, and I guess, scary, and maybe they're more accepted. Can you talk a little bit about that? I mean this this whole idea of burning, I guess, was really foreign when it started. People must have been horrified.

Craig Rudolph [00:36:52] There was a lot of resistance. And I mean, got to say, from an economic point of view, if you're in the timber business that that fire, even prescribed fire, is, can have economic consequences. So you've got to take that into consideration. But once you get the habitat restored, and especially if longleaf pine, which are the most fire-resistant of the southern pines, get put back on the landscape because they were, over much of the area, were the dominant pine at the time of European contact. They're much more resistant to fire than loblolly pine, for instance, which is pretty much the, the species of choice for replanting after clear-cutting.

Craig Rudolph [00:37:47] And so. You know, once you get the burning sufficient to remove much of the midstory vegetation, the vegetation that is trying to succeed into hardwood and maintain it as a pine forest with a basically grassy understory, the fires, and burn it frequently, so you don't have a lot of buildup of fuel, say every three, four or five years, kind of depends. Once you reach that situation, the fires are fairly easily controlled. They don't do much damage at all to the mature trees, which are in the case of most of these pines variously

evolved to resist fires as adult trees. You have a system that's not nearly as exciting when you put a fire in there.

David Todd [00:38:48] But when you first were reintroducing fire, there must have been a fair amount of skepticism, not just among forest owners and managers, but I guess some of the environmental community, too.

Craig Rudolph [00:39:04] Oh, yeah, yeah. I mean, there was a lot of, lot of skepticism. There was from different players in this whole thing, there was a lot of resistance. And prescribed fire is not cheap. I mean, it's an expense that the landowner or manager is going to have to incur to put wildfire on the ground, or prescribed fire on the ground.

Craig Rudolph [00:39:28] So it's a complex issue. And it immediately becomes involved with liability. You know what if you burn up somebody's house on the adjacent ownership? You've got air quality issues. It's a national forest like the Sam Houston National Forest in Southeast Texas is close to Houston, you know, kind of basically in many ways, downwind from Houston. So, you have a lot of restrictions that are placed on burning by the air quality gurus who try to control the amount of pollution coming from prescribed fires.

Craig Rudolph [00:40:16] So it gets very complex, very quickly. And we're trying to do prescribed fire in the case of a red-cockaded woodpecker population, usually in an area that have a lot of in-holdings, a lot of smaller development, second homes, so forth, people that have lived there for generations.

Craig Rudolph [00:40:37] So, it can become very complex. And it's really one of the great concerns going forward in order to figure out how to maintain habitat with adequate prescribed fire on the landscape.

David Todd [00:40:55] Well, I guess this goes back to your comments earlier about habitat fragmentation.

David Todd [00:40:59] And I was hoping...

Craig Rudolph [00:41:02] Yeah.

David Todd [00:41:02] ...that you might be able to comment a little bit about the problems of the isolation of various populations of red-cockaded woodpeckers and the need to figure out ways to translocate them and ensure that they maintain their range and their diversity.

Craig Rudolph [00:41:22] Well, the, the level of fragmentation that the woodpecker experiences right now, and there's probably, other than filling out those blocks of habitat with a, with a population that approaches carrying capacity, there's really not much way to reduce the amount of habitat fragmentation across the entire Southeast. I mean, we're not going to go back to management of older growth forests, or at least forests with some components of old growth and lots of prescribed fire on many areas outside of the existing national forests, at least in my opinion.

Craig Rudolph [00:42:13] So the woodpeckers are going to have to survive in basically, in the situation that they're in now, and as I think we'll probably talk a bit about a little later on, artificial cavities play a huge role in that situation. So that does not cause me particular

concern. I'm more concerned about getting fire on the ground as opposed to genetic issues to resolve fragmentation problems or get involved in resolving fragmentation problems.

David Todd [00:43:00] Okay, so I guess there're sort of first-tier problems and then ones that are or maybe not as critical.

Craig Rudolph [00:43:05] Yeah, absolutely.

David Todd [00:43:07] But all important, but may not of the same priority.

David Todd [00:43:15] Well, can you talk about, you know how, how the translocation has been used in your experience in Texas?

Craig Rudolph [00:43:32] Yeah. I mean, since that, really going back to that first wave of timber harvests across the southern U.S., southeastern U.S., red-cockaded woodpeckers, which were at one time pretty continuous, I mean, they were separated by some of the major rivers and so forth. But that was almost inconsequential compared to the situation they face today. But there had been an ever-declining number of isolated populations separated by huge expanses of unsuitable habitat, which are not going to be breached or changed. I mean, those are there and we're not going to go back to an old-growth forest pretty continuous across the Southeast.

Craig Rudolph [00:44:21] So it poses some difficulties for local populations. They are extirpated. They can't easily recolonize. And even though individual birds are able to move large distances, they can't readily move a large distance, excavate a cavity, reconstitute some sort of the social group, and begin to breed in that habitat. It just isn't feasible. They're kind of locked into the biology they have. And it doesn't make it easy to pioneer in a new site. They need the cavities.

Craig Rudolph [00:45:00] So, and this is really a consequence of the cooperative breeding system that individuals have a difficult time surviving in the absence of other group members. And it's hard for them to develop new small populations.

Craig Rudolph [00:45:16] So the development of artificial cavities was really a crucial step. I mean, it was the crucial step, in my opinion, not only to replace lost cavities but also to allow moving of individuals where individual cavities could be provided.

Craig Rudolph [00:45:34] So, for instance, if you wanted to reintroduce woodpeckers to a sizable block of habitat that was currently unoccupied, you could go put in a bunch of clusters of artificial cavity. And it turns out to be remarkably easy to go get some birds from other populations. And you can, you know, play however much you want with the genetic diversity of the individuals that you bring in, maybe from various places. You can bring those in, put them in those cavities in the evening, screen them into the cavity, go to the site in the morning, pull those screens off about dawn, and, more often than not, those birds will settle right in and start breeding the next breeding season. He's got, you know, you can put a pair in there, so they're good to go. They've got the beginnings of a social group.

Craig Rudolph [00:46:35] And so it worked surprisingly well for them. We were pretty heavily involved in some of the initial work with that at the lab, and I, I was stunned at how well it worked. I mean, I thought it'd work, but I had no idea how easy it was going to be.

Craig Rudolph [00:46:55] But many other benefits follow. I mean, you can, you can establish clusters of cavities in unoccupied habitat, as I just described. But you can also replace lost cavities in the case of Hurricane Hugo, for instance. And so you can move these birds around the landscape and reintroduce birds to vacant habitats. You can expand a population. You can move birds out to the periphery to more quickly grow your population. It just has major conservation benefits. The ability to install artificial cavities and move birds over: this just can't be overemphasized. And it's, it's difficult for me to envision the recovery of red-cockaded woodpeckers without these artificial cavity techniques. I just can't overemphasize it.

David Todd [00:48:05] So, one of the things that I think is so interesting is that you were studying these birds in, you know, a relatively wild and very big landscape and there are understandably problems with tracking these birds, and I guess you start to know their colony sites and so on. But I was wondering if you could talk about the development of the radio transmitters that I guess were used to follow them. But that I guess some critics were worried might increase predation. And then there were some other devices, I guess, that were involved with studying them that, that were used for moving nestlings out of their cavities.

Craig Rudolph [00:48:58] Hmm.

David Todd [00:48:58] But how do you balance the value of what you learn about the bird, you know, so you can protect it, versus the damage that you might do to the bird.

Craig Rudolph [00:49:09] Yeah, and that can also, things can go awry and give you really bad press when you don't need it. But most research activities with various species pose risks of negative impacts. Even observational protocols can disrupt or alter behavior with negative consequences. And working with endangered species is especially challenging because populations are, by definition, small and vulnerable, so small losses can be important.

Craig Rudolph [00:49:41] In the case of red-cockaded woodpeckers, the species was not what one might call, "critically endangered". There were thousands of individuals available and so the substantial population existed. So loss of a few individuals was inconsequential from a population perspective. So consequently, the limited number of deaths, injuries and so forth that is a result of research activities did not really pose a threat to the population. But the decision really comes down to: is the information needed for conservation of the species outweigh the risks. And in the case of red-cockaded woodpeckers, this really wasn't a close call.

David Todd [00:50:32] You know, something else that I've heard from critics, snipers, is that, you know, some of the, the management strategies that were adopted were, I guess, keyed to the red-cockaded woodpecker because it was, you know, quite rare and something needed to be done to stem the losses. But I guess these critics say, "Hey, there are many, scores, maybe hundreds of species in the forest, and these changes that benefit the red-cockaded woodpecker might have harmed these others." And I don't know anything about the truth of these charges, but I was curious if you could talk a little bit about the, you know, whether this red-cockaded woodpecker was a keystone species and the things that benefitted it benefitted many other species, or how you balance this sort of caring for one species versus the whole ecosystem?

Craig Rudolph [00:51:39] Yeah, I think, I mean, you're right. There are differences of opinion on that. I mean, it kind of goes back to the basic idea of prescribed fire. From an ecological point of view, managers are doing, using prescribed fire to kill stuff, I mean, and get rid of

species that weren't originally there when that was a functioning fire-maintained ecosystem. I mean, we're trying to kill off the sweet gums, and many of the oaks, not all the oaks, but some of the species of oaks in particular, and get it back to pine, heavily pine-dominated forest with a grassy understory, herbaceous understory.

Craig Rudolph [00:52:26] So yeah, a lot of stuff woodpecker management is designed to either reduce or eliminate. And I guess the way I look at it is fire suppression has become so prevalent over the last hundred years or more across the Southeast, that really what's endangered is, is the fire-maintained pine ecosystem and the many species that require that type of a fire regime. And if you don't put a lot of fire in there and kill a lot of stuff that wasn't originally there, that's really the big loss.

Craig Rudolph [00:53:19] And that was really one of the things that probably drew me to red-cockaded woodpecker management because the red-cockaded woodpecker was really kind of key because it was listed as an endangered species. It's relatively charismatic compared to many of the other species that live in those fire-maintained forests. And so if you do proper management for the red-cockaded woodpecker, you're in essence restoring and maintaining those magnificent longleaf pine forests that, that originally occurred across much of the Southeast and are so rare today.

Craig Rudolph [00:54:08] The herbaceous flora in particular, of these fire-maintained pine forests in the Southeast support one of the most diverse, herbaceous floras in North America. I mean, the number of species occurring, you know, in a hectare of ground is extremely high. And the wildflower displays, especially in the first couple of years following fire, are indicative of this diversity, and many species of animals also benefit from the restoration of fire-maintained pine forest.

Craig Rudolph [00:54:45] Gopher tortoises further east across the Mississippi River, Louisiana pine snakes, critically endangered species. Bachman's sparrow and many other animal species are dependent on frequent fire for slightly different reasons, but just as much dependent on the red-cockaded woodpeckers, so.

Craig Rudolph [00:55:12] And if you look across the Southeast, just looking at what types of species have been listed under the Endangered Species Act across the southeast corner of the United States, basically these fire-maintained pine forests. Many more of the endangered species are fire-dependent, both plants and animals, than the other species of river bottoms and, you know, other types of habitats across the Southeast. I mean, it's the diversity loss overall among those dependent on frequent fire is just, it outstrips the other types of habitats in the Southeast, the swamps and so forth.

Craig Rudolph [00:55:55] So I mean, fire's such a plus. And I see the woodpecker as a powerful driver of maintaining those fire-maintained pine forests, if woodpecker management is done correctly.

David Todd [00:56:14] Gotcha. So talking a little bit about the, the connection to all these different species, you know, the red-cockaded woodpecker versus, as you mentioned, of course, the gopher tortoise, and the Louisiana pine snake, they Bachman sparrow. Are there other interactions that you could point to that are interesting for the red-cockaded woodpecker and how it has an interplay with other forest species?

Craig Rudolph [00:56:49] Yes, absolutely. One of the things that interested me about the ecology of red-cockaded woodpeckers is how many strong interactions red-cockaded woodpeckers had with other species - more so than most birds, most vertebrates, probably.

Craig Rudolph [00:57:14] But a number of species that they have strong interactions with: pileated woodpeckers come to mind - a much larger species of woodpecker. And it frequently enlarges the red-cockaded woodpecker cavities for their own use and destroying their use for the red-cockaded woodpecker. So Dan Saenz who's a scientist, is a scientist at our lab in Nacogdoches, worked on the interaction of pileated woodpeckers and red-cockaded woodpeckers. And there was a lot of cavity, what we call, the term, "cavity enlargement", going on. And once that entrance to the end of the cavity is enlarged sufficient for a pileated woodpecker or even a flicker to go in, the red-cockaded woodpeckers no longer use those cavities. They abandon them.

Craig Rudolph [00:58:06] And so this problem was ultimately resolved by the placement of metal plates that surrounded the cavity entrance and precluded the larger woodpeckers, and especially the pileated, from enlarging the cavity for their own use. And so that was a problem that was more applicable to small, vulnerable populations. Once the population is fairly large, that's not a population-determining process - enlargement of cavities - to the extent it is in the small ones. But those metal plates have been used quite a bit.

Craig Rudolph [00:58:49] Southern flying squirrels are also frequent competitors that usurp woodpecker cavities for their own use. And biologists often remove flying squirrels from cavities to reduce competition. But again, this is more of an important factor in small, isolated populations. Once populations are basically recovered, you don't have to put so much effort into the removal of squirrels.

Craig Rudolph [00:59:19] Of particular interest to me is the interaction between red-cockaded woodpeckers and various species of rat snakes across the Southeast. And rat snakes are significant predators of the red-cockaded woodpeckers. They're, generally speaking, capable of climbing pretty much any pine tree in the forest. They can just go right up the bole without any necessity for limbs or anything. They just use the many individual scutes or scales across their belly to independently move those and catch little irregularities in the bark, and they can pretty much go straight up the tree. And it's pretty remarkable to watch that.

Craig Rudolph [00:59:59] But it makes red-cockaded woodpeckers extremely vulnerable to predation by rat snakes, especially nestlings and eggs. So we did quite a bit of work with that interaction between rat snakes and red-cockaded woodpeckers. And the woodpecker, in the course of developing the behaviors involved in excavating cavities in living pines, they evolved a behavior, and the behavior evolved, to have what are termed resin wells - little wounds kind of scattered around the entrance to the cavity that they work on daily. They'll peck on them a little bit. It's like picking a scab. You just get that accumulating resin chipped off, and new resin will be produced. And while it's quite liquid, it'll flow down the bole of the tree and you'll have this sticky curtain of resin that may reach all the way to the ground.

Craig Rudolph [01:01:05] And that serves as a very effective barrier to the ability of rat snakes to climb the tree. They'll start up a tree with a good sticky fresh resin barrier, and as they move those individual scales on their belly, they'll pick up little bits of resin, that will tend to start sticking those scales together and make them hard to manipulate individually. And eventually, the snake gets enough resin on its belly scales that it can no longer climb or even maintain its purchase on the tree, and it'll just fall to the ground.

Craig Rudolph [01:01:43] And so that, it's really an effective barrier, and another subsequent evolution of a behavior that increases the dependence of the red-cockaded woodpecker on living trees because they have to have that resin barrier. And if the tree dies or is even weakened to the point it stopped producing much resin then the woodpeckers will abandon it. They need that, that barrier to keep, keep rat snakes out.

Craig Rudolph [01:02:24] So I think that's one of the most fascinating little aspects about the biology of the species. And it drew me to them initially.

David Todd [01:02:37] Yeah, well, and you mentioned these interactions between red-cockaded woodpeckers and certain flying squirrels and Bachman sparrows and, of course, rat snakes. What about the interplay between the red-cockaded woodpeckers and the southern pine bark beetles, which I guess are both a prey species, but also these beetles can kill the trees that are host to the woodpeckers and I guess...

Craig Rudolph [01:03:14] Yeah. I mean, that's, that's a fascinating interaction. And it's extremely complex, and I don't tend to understand everything about it. But in any event, prior to the turn of the last century, meaning 1900s to 2000, southern pine beetle outbreaks, often involving the loss of thousands of hectares of pine habitat, red-cockaded woodpecker habitat, occurred every, I don't know, seven to 10 years. And since that period, for reasons that I don't understand, I don't know that anybody understands them, those outbreaks no longer occur. Southern pine beetle's almost endangered itself.

Craig Rudolph [01:04:02] But anyway, back when these big outbreaks were happening every decade or so, all the species of southern pines were susceptible, although loblolly pine was the one that was the preferred species for planting and now has replaced longleaf and dominates the landscape across the South, is one of the more highly susceptible. And longleaf is, which was largely replaced by loblolly, it is highly resistant due to a more copious resin production. That is what impedes, it's the defense, one of the defenses, of the tree against beetle activity.

Craig Rudolph [01:04:41] So the landscape has changed greatly from the point of view of that of the southern pine beetle. It's much more conducive to these big outbreaks than it was 100 years ago. The ecosystem is overall much more vulnerable to outbreaks than it was in the past. And as a consequence, thousands of hectares, as you mentioned, of habitat and hundreds of cavity trees are at risk of mortality, or were at risk of mortality, in just a few months' time. I mean, these outbreaks could occur during a summer and take out huge swaths of red-cockaded woodpecker habitat, timber resource, and so forth.

Craig Rudolph [01:05:26] Conversely, as you alluded to, the developing beetle in the dying trees in an outbreak situation produced a super abundance of prey, namely the beetle themselves and their larvae and so forth. But even between epidemics, when there were years of low beetle abundance, there were always a few infested trees around: that low abundance of dying trees provided a very consistent and significant food source for red-cockaded woodpeckers. And if you would follow foraging groups around, they would often go first thing in the morning, when they'd come off the roost, they would go to the nearest southern pine beetle-infested tree and maybe feed there for an hour or more on that one tree. And that was of very substantial benefit to them.

Craig Rudolph [01:06:22] And so there's this sort of tug between loss of cavity trees, or most of your habitat to southern pine beetle during outbreaks, versus this kind of constant food supply of fairly high quality, or very high quality, during the years between outbreaks.

Craig Rudolph [01:06:47] But from a management point of view, control of southern pine beetle is difficult, complex and raised strong emotions, I guess, among managers. Effective methods currently involve cutting trees, often healthy trees, around an outbreak, often in considerable numbers, sometimes hundreds of trees, if it's a big spot. And these control measures must be rapidly applied, resembling really a response to fire in terms of the short duration of time where you need to get out and address this issue, because these spots can grow extremely rapidly and they just, they just mushroom and grow. There's more and more periphery for them to grow and infest more and more acres at a more rapid rate.

Craig Rudolph [01:07:37] So it can be a big problem. In the 80s and 90s, there were huge outbreaks across the South, especially in Texas. We had some major outbreaks. So, the differences of opinion over control versus no control, strategies for control, developed between conservationists, the U.S. Forest Service, timber interests. It was a very contentious issue. And the red-cockaded woodpecker was kind of caught in the middle of these differing opinions and eventually resulted in litigation and became quite a deal.

Craig Rudolph [01:08:17] The issues remain largely unresolved, and should southern pine beetle epidemics return to the region, which I suppose they could at any time, the red-cockaded woodpeckers / southern pine beetle debate will return as well, with who knows what the consequences of that will be.

Craig Rudolph [01:08:37] And the more time passes, the more managers and landowners and so forth tend to forget what worked, and what didn't work, and just how to manage these big epidemics. That's true, I fear, of personnel in the Forest Service, as well as the timber companies, and private, you know, small private landowners. It's going to be a lot of relearning the lessons of the past. And maybe lawsuits will be generated again, who knows, or maybe the beetles won't ever come back in large numbers, at least.

Craig Rudolph [01:09:36] Hello?

David Todd [01:09:41] I was just saying that it seems.

Craig Rudolph [01:09:44] I think I lost you for a minute.

David Todd [01:09:46] Yes. My apologies. No, I was just, I guess, sort of confirming what you were saying that the institutional memory of the Forest Service, or the timber industry managers, may be less or shorter than the return cycle for these pine bark beetles and that the next. Well, you know, you've lost the experience and the knowledge.

Craig Rudolph [01:10:10] It's also the woodpecker biologists. I mean, they're going to have to relearn these lessons. I mean, it's written down, but people learn best on the ground. So we'll see.

David Todd [01:10:29] Yeah, well, you know, you mentioned that the southern pine bark beetle spurred some litigation in the, I guess this was in the '80s, which, you know, grew to include issues about the red-cockaded woodpecker, and, and, and I was curious what your

thoughts are about the use of lawsuits to protect the species and enforce management changes on the landscape.

Craig Rudolph [01:11:00] Mm hmm. Yeah. Well, let me, let me preface this by saying that, generally speaking, I think litigation is a, is a very blunt instrument to resolve conservation issues. I mean, outcomes are hardly ever ideal, and unintended consequences are frequent, and compromise is often the outcome. And this is not generally a bad thing in human interaction. I guess that's why we have lawsuits as frequently as we do. But in conservation issues, compromise that benefits the species at risk, often with major concessions made perhaps by both sides, is, and with a lot of pain, either economic or, you know, loss of a species, whatever, is not sufficient to preclude a path to extinction. Compromise is kind of the enemy of success in endangered species work.

Craig Rudolph [01:12:10] And I guess salmon populations are a classic example in the Pacific Northwest. I mean, there's lots of litigation, lots of compromise, and lots of salmon population decline.

Craig Rudolph [01:12:25] So anyway, but at the risk of oversimplifying, in the case of the red-cockaded woodpecker in the '80s and '90s, there were three factions involved. There was the larger timber industry, including the major timber companies, large and small private landowners, elements within the U.S. Forest Service seeking to increase fiber production and profits, basically. And there were then conservation groups, most notably the Texas Committee on Natural Resources and its lead lawyer, Ned Fritz. And they were working to increase protected forest lands and the diversity. And then there was the third group that, a diversity of biologists seeking to understand the biology of the species and devise protocols to prevent the extinction of the red-cockaded woodpeckers. So you've got these three factions and then they get all tangled up in court.

Craig Rudolph [01:13:28] So the U.S. Forest Service is really the only significant custodian of forested land in public ownership and practiced, at least in theory, a policy of multi-use management, but in practice, that overemphasized resource extraction in relation to ecosystem management, which, I guess, has always been a source of contention in the dealings with the U.S. Forest Service and the public.

Craig Rudolph [01:13:59] In any event, management with regard to red-cockaded woodpeckers could best be described as one of managed extirpation. They were quite good at protecting existing birds without allowing for population replacement or growth. Which is, you know, slows the inevitable, but really doesn't solve the problem. And the Texas Committee on Natural Resources sued the Forest Service in an attempt to reduce the emphasis on resource extraction and increase the emphasis on ecosystem preservation, to get it back, to get it back, to get it to a more balanced approach between those two goals. And ultimately, I think the red-cockaded woodpecker became a stalking horse for the preservationists' cause, for the conservation litigants.

Craig Rudolph [01:14:56] But red-cockaded woodpecker biologists, especially the ones of us that were in the U.S. Forest Service, were kind of caught in the middle of all of this. And, speaking for myself, I argued for a management plan that would recover the red-cockaded woodpecker and crucially, the ecosystem as well. It would support the species without specific interventions - artificial cavities, squirrel removal, and so forth, having to go on in perpetuity, to have a more natural, functioning, viable population in several areas across the South.

Craig Rudolph [01:15:38] So many meetings were held. Court proceedings took place. Progress was slow. And Ned Fritz, with the Texas Committee on National Natural Resources, despite his great love of wilderness, and his desire to use the red-cockaded woodpecker to advance his cause, which was to have more wilderness in the southeastern U.S. (I think that was one of his main goals), could never really accept the absolute need for fire in southern pine ecosystems, and especially prescribed fire. He would argue that a "let burn" policy with natural ignitions was sufficient. And in a very fragmented habitat where fires can't spread over large acreages, or be allowed to spread over large acreages, it just isn't going to get a return interval sufficient to maintain the ecosystem. So I would argue that a prescribed fire is absolutely necessary in the Southeast.

Craig Rudolph [01:16:44] But eventually, these legal battles dwindled, without clear resolution. By the time that the lengthy litigation, along with generational change within the Forest Service, newer ideas coming into forest service management had resulted in changing perspectives and feasible compromises from both points of view. Pretty much resolved the problem. I mean, nobody was totally satisfied. It was one of those kind of compromise-type situations.

Craig Rudolph [01:17:20] But I think it was adequate, at that point in time, to allow the conservation, the successful conservation of the red-cockaded woodpecker pretty much across its historic range to occur. But this outcome would really never have occurred, or been very much delayed, without the, I guess, what I would describe the difficult presence of Ned Fritz. I mean, he had a, although I didn't agree with a lot of his sort of biological / ecological viewpoint, especially related to fire, he was very committed and we would have never gotten to the, to the point where the conservation of the red-cockaded woodpecker was doable without his efforts over many years.

Craig Rudolph [01:18:31] He generated a lot of controversy. A lot of people had very strong feelings about him, but with all his, what I would call misconceptions, he was a crucial player in this whole story.

David Todd [01:18:49] It's interesting, you know, how I guess there are these different theories about how history moves, and you know, that there's these, these big intergenerational forces of, you know, people learning more about the bird or, I guess, retirements and attrition within the Forest Service. But then there's this sort of well, maybe sometimes there's these catalysts, you know these very special people, sort of great man theory. Like, you know, that Ned Fritz, you know, was able to goad people and make them move a little bit faster than they would normally.

Craig Rudolph [01:19:27] Oh, I can remember being, at times, very angry with Ned, but I considered him a good friend, as well. And you know, as things, kind of, the passage of time, and things kind of came into perspective, he was, he was crucial in the whole process.

Craig Rudolph [01:19:52] And that, you know, just by the way legal precedent and so forth works in our society, what, what was really a local issue in Texas, these lawsuits and so forth, the, the outcomes in court were sufficiently negative from the point of view of the Forest Service, that much better forest management, from the point of view of the red-cockaded woodpecker and the southern pine ecosystem, spread rapidly across the entire Southeast, the entire southeastern region of forest.

Craig Rudolph [01:20:36] I mean, it didn't it didn't remain just a Texas issue, a Texas solution. Once, once it started going, it spread all the way to Florida and the Carolinas, and resulted in a pretty darn good recovery plan under the Endangered Species Act, one of, one of the better ones that's been around, in my opinion.

David Todd [01:21:04] So we've, we've been talking for a while about the past, and I was, I really enjoyed reading the book that you and Dick Conner, and Jeff Walters wrote, "The Red-Cockaded Woodpecker - Surviving in a Fire-maintained Ecosystem". And, and, you know, it documents a lot of what you did and learned. But it also, oh, I think, looks into the future, and I was wondering if you might do the same today and just try to tell us a little bit about what you foresee for the bird?

David Todd [01:21:42] I'm particularly curious, given that I guess last year there was a proposal to downlist it. And I was curious what you think about that?

Craig Rudolph [01:21:54] Mm hmm. Well, in the book, which, as you said, was coauthored by myself and Dick Conner and Jeff Walters, was published in 2001. And I think in the book as a whole, we attempted to make the case that, at that time, 2001, there was sufficient biological and conservation knowledge to recover the species and its ecosystem. And we always stress the bird AND the ecosystem. And by that, we're talking about all the other hundreds of endangered species in fire-maintained southern pine forests. Which, recovery plans for endangered species are often much more narrowly focused, and it seems like they've become even more so in recent years, which I think is a mistake. I think it's kind of a recipe for failure in many cases.

Craig Rudolph [01:22:53] But in any event, we argued that there was sufficient knowledge to recover the species and the ecosystem. And that this could be accomplished while still producing significant levels of fiber, wooden pulp for the economic benefit, substantial economic benefit, from national forests in the Southeast.

Craig Rudolph [01:23:18] But, in turn, this requires the societal decision to implement the required practices. And I believe this is still true. But the jury is still out. Basically what we said 20 years ago. Well, I think that's still the case and it's maybe even a little more problematic today. I was quite hopeful in 2001 - younger and more hopeful.

Craig Rudolph [01:23:51] I think it really comes down to politics being the main driver. And currently my major concern is the reaction to increasing wildfire severity due to decades of fire suppression, often led by the Forest Service, and the emerging impacts of climate change. And the situation, really nationwide, in relation to fire is changing quite rapidly. So I, I fear that overreaction may result in an increased aversion to the use of prescribed fire. I felt, in 2001, that prescribed fire was kind of coming into its own, and I think it's even more crucial that that happened today, but I'm not sure that will be the political outcome.

Craig Rudolph [01:24:45] I mean, even within the last 20 years, there's been an increasing lack of commitment to prescribed fire programs across the South. We see this in the red-cockaded woodpecker world. I've done some work with the Louisiana pine snake, which is an endangered species, threatened species, also dependent on fire-maintained southern pine forests and getting sufficient fire on the ground is extremely difficult in that case. It's a snake. It's not as charismatic as the woodpecker.

Craig Rudolph [01:25:23] So, I think generally now I think that getting sufficient fire back on the landscape in the pine forests of the South has always been a challenge, and it would be very unfortunate if political decisions made it even more difficult. And I think the reaction to increased wildfire, climate change, the interplay there, is going to result in some bad political decisions being made. We've already seen movement in this direction. So that's a big concern for me.

David Todd [01:26:14] That's so interesting. It's like we should know better. You know, the research is there, the knowledge is there, but the politics and the realities on the ground are just make it very difficult.

Craig Rudolph [01:26:24] Fire is a very emotional issue. I mean, Ned Fritz was an example of that. I'm probably an example of that. And the general public whose town just burned to the ground is certainly going to feel that way. So it's hard to reach the best decisions. It's too contentious. It's just difficult. And when there's no easy fix, I think people, politicians, the public, tend to make wrong decisions. Maybe biologists, too.

David Todd [01:27:23] Well, you've covered a lot of ground.

Craig Rudolph [01:27:29] We've covered a lot of ground.

David Todd [01:27:32] It's been fun to be along for the ride. I had one last question and that is just a kind of open-ended one. Given what we've talked about so far, is there anything that you feel you didn't get to say before, but would like to say now. Any sort of last thoughts?

Craig Rudolph [01:27:54] No, I don't think so. I think you led me through most of the points.

David Todd [01:28:10] Okay. Well, we can leave it there. Thank you so much for teaching me about all this stuff and, and all the others that will listen to this conversation - really valuable, really interesting. So thank you.

Craig Rudolph [01:28:24] Well, I hope so. And I enjoyed the process.

David Todd [01:28:30] Well, thank you for your patience.

Craig Rudolph [01:28:36] I got to think about southern pine forests, in some depth, for the first time in quite a while. So that was, that was enjoyable.

David Todd [01:28:47] Well, thanks for taking us on the tour. And again, much gratitude for your time today and I hope our paths cross somehow soon.

Craig Rudolph [01:29:00] Yeah, that would be nice.

David Todd [01:29:02] Okay, well, thank you. Take care.

Craig Rudolph [01:29:07] Okay. Thank you.

David Todd [01:29:10] Bye now.

Craig Rudolph [01:29:10] Bye.