

# Fire Ecology Chats: A Podcast Series by the Association for Fire Ecology



## Transcript of Episode 18 - Pre-Columbian red pine (*Pinus resinosa* Ait.) fire regimes of north-central Pennsylvania, USA

Host: Robert Keane (Editor of Fire Ecology and Retired Research Ecologist, USDA Forest Service, USA)

Guests: Joseph Marschall and Daniel Dey

Link to Full Article in Fire Ecology: <https://fireecology.springeropen.com/articles/10.1186/s42408-022-00135-6>

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**Bob Keane:** Good morning everybody. My name is Bob Kean. I'm the editor of the journal Fire Ecology that is sponsored by AFE and done by SpringerNature. This is the Fire Ecology Chats and today we're very lucky. We have Joe and Dan to talk about the study, Pre-Columbian red pine fire regimes of north-central Pennsylvania. Joe, why don't you go ahead and introduce yourself?

**Joe Marshall:** Sure. Hello, everyone. My name is Joe Marshall, and I'm a Senior Research Associate at the Center for Tree Ring Science at the University of Missouri. And I also coordinate activities for the Oak Woodlands and Forest Fire Consortium, one of 15 Fire Science Exchanges funded by the Joint Fire Science Program.

**Bob Keane:** Thank you very much, and Dan?

**Dan Dey:** Hi, I'm Dan Dey. I'm a Research Forester with the US Forest Service. I'm in the Northern Research Station, located in Columbia, Missouri, where I'm also project leader of a research work unit.

**Bob Keane:** Great, thank you both for coming. Joe, why don't you go ahead and give us the elevator speech of this paper? What is it about this paper that makes it special?

**Joe Marshall:** Sure, happy to do that. In this study, we recovered and dated the oldest fire scar record in eastern North America using old dead red pine wood, stumps, and snags that we found in this forest. And we had been working in this region for quite a while, specifically in this exact landscape since 2015. We had reconstructed fire history at one site, which was pretty similar to most fire history studies in terms of spatial extent and sample numbers. We collected about 40 trees from a few 100 hundred acres at this site in north central Pennsylvania. In doing so, we discovered that the landscape surrounding this area was particularly rich in old remnant wood that was well preserved. We then expanded the study to look at the spatial variability of historical fires to take advantage of this resource of old wood. We collected about 200 more samples for that study. In the process of collecting those samples and dating those trees, we discovered that we had samples from four trees that could not date using our you know, standard dendrochronology methods, they had plenty of rings, plenty of variability, they should have dated. And so we hypothesized that these were likely exceptionally old pieces of wood that didn't overlap sufficiently with our dating chronology, which at that point went to about 1600. And so our project partners, the Pennsylvania Game Commission decided to support further sampling in that landscape to try to verify the dates of these old trees that they in fact, did predate most of our chronology. And so we collected 70 more samples. And we successfully bridged the tree ring time gap there between our previous

chronology and these new trees. And we were able to absolutely date these trees. The end result is a tree ring record in red pine that goes back to the year 1370 and a fire scar record that goes back to the year 1402.

**Bob Keane:** That is amazing. It truly is. When I read this paper, I was just, I couldn't believe that first of all, you found so many trees and second that they went back so deep. Dan, how did you find all of these remanent red pines?

**Dan Dey:** Well, I think some of our initial inquiries into Pennsylvania probably came out of a collaboration with Pat Brose, who's also a Research Scientist with the Northern Research Station and also a number of state conservation employees, who once they realized what the stumps and snags looked like, they started seeing them, you know, throughout the region and then that's kind of where it took off. Joe is actually the boots on the ground who spent the days hiking over hill and dale to find the best material in the best areas to develop the studies.

**Bob Keane:** So red pine must have a lot of resin in it or something for all these old samples to continue to be existing or evidence on the landscape?

**Dan Dey:** You're right, it confers to the wood a lot of decay resistance and it allows them to persist for hundreds and hundreds of years in the woods still with enough material for us to do a good job of reconstructing the fire history.

**Bob Keane:** That is incredible. I get a question for you, Joe, do you have any idea what started these fires?

**Joe Marshall:** I'd like to just back up for a quick second. Dan brought up this previous work that we did in the region, about 30 miles away from this study site with Pat Brose and Dan and some other folks. We, in 2013, did some fire history work in red pine and we discovered there are records went back to about 1600. And we saw that there was frequent fire in the very early 1600s. We discovered, you know, really well replicated fires happening at about every seven years or so. And then they shut down at about 1650. And then there was a long break of no fire. So we went into this study, wondering what was the fire regime prior to that 1600 spate of fires we had seen and what caused this long interval with no fires that occurred, you know, all across the region starting in the early to mid 1600s. With this information now that we gleaned from this new study, we saw that there was frequent fire preceding that time period of the early 1600s. And then there was, again, a very long period, about 100 years of very minimal fire activity. And so when we take all of this evidence together, and we also consider how fires start, in modern times in the region, it's very apparent that this is a fire regime that is largely influenced by human ignitions. Modern lightning storms that happen in this area almost always occurred during periods of extreme high humidity and also are accompanied by rain. And we see that well, less than 1% of wildfires in modern time since about the 70s, are started by lightning. And so this and some other lines of evidence point that humans have been the major source of ignitions in this landscape.

**Bob Keane:** That's very interesting. Dan, did you find synchrony between the fires? In other words, was it a bunch of large fires or a bunch of small fires that happened on the landscape?

**Dan Dey:** Well, it's a little bit hard to say about size because that would take a lot of intense, systematic sampling. But we can see if fire did burn in the same year at many sites. We can't really say that it was the same fire or just concurrent fires in different areas. But in terms of synchrony, we do get some indication in a lot of our fire history studies where we might have 30 to 50 sample trees, and many of the fires recorded occur on just a few trees out of that sample in a lot of the fire years. But in some fire years, a majority of the sample would be

scarred. And so we conclude that those were higher severity fires. So it's kind of a mixed severity fire regime over time, with low intensity being the most dominant, but moderate to high intensity most likely concurrent with periods of drought.

**Bob Keane:** Well, one last question I have for you, Joe, is what were the mean fire return intervals that you found with this area?

**Joe Marshall:** This whole study area is atypical in terms of fire history study sites because it covers a very large spatial extent, about 35 square kilometers. If we just look at that mean fire return interval for that entire landscape, we see that it's really frequent, you know, it's like fire every 1.6 years or so from the beginning of our record in 1402 to the end of our fire record in 1966. But we also divided that landscape into management units, similar to most other fire history studies, and also kin to what land managers might manage at, the same spatial scale, so kind of at a stand level. And when we break it down into to that spatial extent, we see that fires occurred during that whole time period, probably every about seven years in these management units. During the earliest part of our record, which is kind of the most interesting part of this study from 1402 to 1609, we discovered that fire occurred approximately every 10 years at that same spatial extent.

**Bob Keane:** That's an amazing study and I really appreciate your time that both you gave to this. Joe, do you have any funding that you'd like to acknowledge?

**Joe Marshall:** Sure. All of the research that is contained within this study was directly supported by the Pennsylvania Game Commission, they are a state land management agency that is concerned mostly with wildlife habitat. And also the work that preceded this, the studies that Dan mentioned that we conducted with Pat Brose and others, that work was funded by the US Forest Service Northern Research Station.

**Bob Keane:** Well, thank you both for your time and for a description of the study. I hope people download this from the Fire Ecology website. Oh, and read this wonderful paper. Thank you both.

**Joe Marshall:** You bet.

**Bob Keane:** Goodbye.