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

Transcript of Episode 22 - A systematic review of empirical evidence for landscape-level fuel treatment effectiveness

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Bob Keane: Hello, everyone. My name is Bob Keane, and I'm the editor of the journal Fire Ecology, and this is Fire Ecology Chats. Fire Ecology Chats is a podcast to talk about the papers that have been recently published in Fire Ecology. Today we have a very special speaker talking about a very important topic. Shawn McKinney, you're our new speaker, and would you tell us about yourself?

Shawn McKinney: Hi, Bob. Thanks for inviting me to do a Fire Ecology Chat. This is really exciting. I am an ecologist with the US Forest Service, Rocky Mountain Research Station, and I work at the Fire Lab in Missoula, Montana.

Bob Keane: Well, thanks for coming Shawn. I really appreciate it. Today, Shawn is going to talk about his paper, "A systematic review of empirical evidence for the landscape-level fuel treatment effectiveness." There is nothing more important today, if you read in the media about fuel treatments and their effectiveness. So I'm really glad you did this wonderful study or literature review on the topic. Shawn, can you tell us why you decided to write this paper?

Shawn McKinney: Sure, this paper came out of a broader project, a larger effort to, like you said, address fuel treatment effectiveness at really broad spatial scales often referred to as the landscape. The main goal is to really understand what characteristics of fuel treatments make them most effective at mitigating the adverse effects of wildfire. For example, if we can identify the type, the density, the spatial arrangement of treatments that are most effective, then this information can be used to design future fuel treatment projects, that should have greater impact. So I have some experience in my research pasts conducting systematic literature reviews, and meta analyses, and of course, with fire ecology. So I was brought on to this project that was led by Terrie Jain. After we designed our study and conducted our initial literature search, it became evident we were really dealing with kind of three populations of information, if you will: those from empirical studies with observable, quantifiable, meat and potatoes type research; those from simulation studies; and those from case studies. So the whole team kind of broke our information along these three lines, and then I served as the project lead for the empirical study, which is what this paper is about.

Bob Keane: Yeah, I gotta admit, this paper is extremely interesting, even though it had some not very exciting results. Shawn, could you tell us about what you found in your literature review?

Shawn McKinney: Right, I kind of feel the same way. There's not really a profound graph I can point to or quantitative results. But when I step back and really look at this holistically, I actually think there's a profound contribution that that my coauthors and myself made. First off, why I wanted to be on this empirical team, if you will, or why empirical evidence is important to begin with, just a little bit of information on that. You know, it's the strongest form of information that we have to understand natural systems. Of course, case studies and simulation studies have their benefits and contribute to overall understanding, without a doubt. But empirical evidence from a systematically designed study is the core of the scientific method. And that's the method we use to understand how things operate in the natural world. That's, you know, just kind of science 101. So therefore, if we want to understand the where, the what, the when, et cetera, of what we need to do to optimize fuel treatment effectiveness, we ultimately want to test different concepts empirically. So the first step to this process is looking at the literature to see what has already been done and what we know at this point. And that was really the main point of the study.

What we did was a systematic literature review, data extraction from the identified papers, and a synthesis of that information. So it's, you know, a pretty straightforward process. It's pretty well defined, especially in the medical field. You can look to their guidelines and really do a well thought out study. We cast a really wide net because we just didn't want to miss anything. In part that was because we weren't quite certain what we were looking for and what we'd find and that was kind of a difficult part to that, and I'll touch on that a little bit here in a few minutes. My personal initial inclination was that we would not find too many straightforward empirical studies of fuel treatment effectiveness on wildfires, given the obvious challenges to conducting such studies. But I wasn't sure what type of information might be embedded within other studies that that could be useful to our needs. So our initial search resulted in 2240 papers. So we were pretty confident we weren't missing anything. But we also had, you know, a fair amount of work to get through all those. We ended up including only 26 papers in our synthesis. And in the end, only 12 of those 26 papers provided some evidence, or at least attempted to gather data, on what is truly a landscape-level effect.

Bob Keane: So what did these 12 papers find? Were true fuel treatments effective?

Shawn McKinney: First, I think what the main finding was, is somewhat surprising to me. And this gets back to what we were touching on just a moment ago. What was really neat is it came about in a truly organic and investigative way. Most of our research, we kind of get used to what we expect to find, maybe not the exact value, but you're rarely overwhelmingly surprised, at least in my experience. So it's somewhat of a satisfying and enjoyable journey and the result is conceptual rather than quantitative. But I think it is fundamental and necessary to advance the field and begin the task of addressing more precise and actionable questions. What we found was that the notion of what is meant by landscape varies broadly and is rarely, if ever, precisely defined or described. But this transcends semantics because it gets to the heart of what we are not doing and need to be doing to get answers to the difficult questions of optimizing effectiveness.

In general parlance, most of us understand that landscape in the context of size or area generally means something large, that is heterogeneous in it's fundamental characteristics of vegetation types across a broad area, for example. This idea of landscape is what permeated the literature that we found, you know, they talked about big treatments, big fires, etc. But for the purposes of acquiring data to inform the effectiveness question, what we really need to be discussing is landscape as a process. That is, treatments can affect wildfire behavior in locations outside of their treatment boundary. How can we array a number of treatments that represent a certain proportion of a watershed, for example, that will have the maximum effect of mitigating a wildfire that burns through that watershed? Most of the studies in our final pool were truly about site-level effects. They compared wildfire behavior or effects within a treatment boundary to areas that were untreated. This approach

does not provide the information necessary to begin to tackle the bigger question. There is a lot of data to show treatments have site-level effects. But we need to begin to design and implement studies that test landscape-level effectiveness. We hope that this paper begins this dialogue. First, the recognition of the distinction between site-level and landscape-level. And second, how best to approach addressing landscape-level studies. I now have my antennas up for anytime I see and hear landscape-scale or landscape-level and fuel treatment, whether it's a talk or a paper, and I immediately run to it. And what I'm still finding is people are talking about site-level effects. So I hope this paper really can have an impact on that because we can't get to the hard work until we're all on the same page, so to speak.

As for the 12 studies that really are our second main finding, the information we pulled out, is optimistic because 1) there was empirical evidence for landscape-level effect of a fuel treatment, meaning treatments were applied at a certain location and the researchers were able to identify a change in fire behavior outside of that treatment. So that at a minimum, were proof of concept that this can work. But that's really still where we are getting to the questions of optimization and design. What types of treatments, what shape, what density, etc, how to implement. We still don't have information to begin to answer that, because each of these studies acquired those data, somewhat surreptitiously, you know, accidentally, and I don't mean that as a slight, but that it was really was a site-level study that was able to acquire these other data. And so that's really where we're at. And one thing I'd want to point out, and we tried to be really careful of in the paper, is that this isn't really a critique or criticism of people doing this work or who had done, you know, the work and published up to the date of the review. Clearly, there's a vast number of logistical and practical hurdles to overcome to acquire the data to address these questions. You know, it's one reason why the simulation studies and the paper that's coming out of that, you know, had hundreds of studies. You can and continue to generate and learn through your simulation and modeling exercises, but doing it on the ground is a completely different endeavor. But I think it's important that we begin to discuss how to overcome them. And the difficult task of implementing some of these studies.

I think with the recent attention and funding for mitigating wildfire effects that you alluded to in the introduction, that this is a time to carve out resources to implement studies that should be viewed similar to long-term monitoring projects. I used to work for Department of Interior as an ecologist for a long-term monitoring group. And you know, that's really the mindset you have, you still visit things annually, or at some type of temporal frequency, they're still maintenance, there's work to be done. But it may take a while to learn. And in our case, you know, the experiment, in air quotes, is the wildfire, obviously. So we can design treatments, what our best hypotheses lead us to believe, coming from the results in simulation studies, let's apply those on the ground in different watersheds and take a really good empirically-designed study approach. But then you really kind of have to sit back and wait for wildfires to occur and learn from that. But I think if we don't start that process, then we're always going to be limited in our understanding of where we really want to get to.

Bob Keane: Yeah, I know, when I was in the literature, I was amazed at all the confounding factors that took to actually evaluate efficiency or efficacy. Namely, it was all about how big the fuel treatment was, what proportion of the landscape got treated, what was the fire behavior at the time the fuel treatment was burned, and so on. Did you find that in your studies, that there were so many governing factors that it was impossible to evaluate your efficiency?

Shawn McKinney: Without a doubt. But almost more fundamentally, the way they were designed, that is, how the data were collected, you weren't allowed to. For example, if we have treatments removing, you know, as much as the standing vegetation as possible across a watershed, and then a fire comes through, it's relatively straightforward to measure severity, for example right a really important parameter, within the treated area and

outside the treated area. And overwhelmingly they say, well, severity was lower. Okay, that's good. That's the first step. But what we don't learn from that is, how did that density of treatments, how could that have been optimized? What was their shape was, you know, a lot of the things as I think you're aware of that, that we do in simulation studies, that's not being done on the ground. But you're right, without a doubt, there's so many uncontrolled variables. Of course, the weather, the climate, on the days of the fire, right, that's a top-down effect are going to have an effect on anything. So no two studies might be able to be completely compared. But of course, we can do statistical modeling and other approaches, with the empirical data to somewhat account for that. There are a lot of variables, of course, just looking at, if we're dealing with the entire United States and we're worried about, you know, the adverse effects of wildfire in our modern era, clearly vegetation types, regional climates, topography, all those normal players are going to have their effects. So there's, there's no doubt this is a daunting task. But we believe the important part is truly starting to talk about things all in the same way. So again, not as a criticism, but when someone comes forward and says, hey, I've got a landscape-level study planned and this is what I'm going to do and it's a really big area. And you can say that, well, yes, you're right, that is a really big area but you are still just measuring site-level effects. And in terms of the inference we can draw from that, it's no different than what we already know.

Bob Keane: Well, Shawn, I want to thank you for this really interesting chat we had today. Appreciate your time, and I appreciate your wonderful insights on this very important topic. Would you like to recognize any funding agencies before we sign off?

Shawn McKinney: Yes, this broader project was funded by a Joint Fire Science Program, who clearly has an interest in this information. They have funded a lot of the studies that are trying to get at these questions and so their main information need was what's the state of knowledge? Where are we at? And that's the broader project I spoke about and beginning. And of course, we had funding from the Forest Service, Rocky Mountain Research Station for salaries and publications and things of that sort. I'd also like to recognize my coauthors on this: Ilana Abrahamson, Terrie Jain, and Nate Anderson, who were valuable contributors to this project as we worked through it over a couple of year effort. And I want to thank Fire Ecology for publishing our paper and for inviting us to do this podcast. It's really exciting.

Bob Keane: Well, we surely appreciate it. And thank you again, Shawn, for coming and chatting with us. This paper piqued your interest, please go to fireecology.org and download this paper. It's free. Until next time, this is Bob Keane with Fire Ecology Chats.