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

Transcript of Episode 15 - Assessing the role of short-term weather forecasts in fire manager tactical decision-making: a choice experiment

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Bob Keane: Hello everyone, my name is Bob Keane. I am the host of the podcast Fire Ecology Chats. Fire Ecology Chats is a podcast all about interesting articles in the journal *Fire Ecology*. *Fire Ecology* is hosted by AFE, the Association for Fire Ecology, and it is produced by SpringerNature. We'd like to welcome everybody. Today we're going to be talking about the paper Assessing the role of short-term weather forecasts in fire manager tactical decision-making: a choice experiment. This came out in the middle of November, and we have two of the authors of that paper here today. Claire Rapp, would you introduce yourself and your affiliation, please?

Claire Rapp: Absolutely. My name is Claire Rapp. I'm a PhD candidate over at Ohio State University in the School of Environment and Natural Resources. And my research specializes in decision science, how people make decisions, particularly how fire managers make decisions.

Bob Keane: And today we also have a gentleman who I am quite familiar with. I worked with Matt Jolly for quite a number of years at the Missoula Fire Sciences Lab. Matt, you want to introduce yourself?

Matt Jolly: Thanks, Bob. My name is Matt Jolly. I'm a research ecologist with Rocky Mountain Research Station, Missoula Fire Sciences Laboratory with the US Forest Service. Most of my work centers around leveraging information like weather data or decision making, both in the United States and abroad.

Bob Keane: Thanks, Matt. Claire, can you tell us about this paper?

Claire Rapp: So this paper has a couple methods. It's a survey that we issued to Forest Service fire management officers. The main goal of this paper was to understand how fire managers use different weather forecasts, different pieces of information, to decide whether they were going to directly or indirectly attack a fire during the transition from initial to extended attack. We used a choice experiment, which is a method that helps us understand the relative importance of very specific variables at different levels for informing fire manager choices. So we looked at how important is precipitation, how important is humidity, how important is wind and a couple other variables to get a better grasp of how fire managers are using the weather forecasts available to them.

Bob Keane: Very interesting. Well, I've always wondered that. So Matt, what did you find out?

Matt Jolly: Well, I think that's really important to note that the original purpose of this was really to also understand where we can focus our efforts in forecasting as well. But in terms of what we found out, looking at the importance of things like initial framing, which I'd love for Claire to follow up on, about how the first information they receive influences the decisions they make, but also how the weather itself, so things like precipitation and wind speed being important in decision making, and less so for things that we put heavy emphasis on, like fire danger, indices, and temperature and humidity.

Bob Keane: So Claire, what kind of survey was it? How many answered it? And what kind of fire managers did you send it to?

Claire Rapp: So we sent it to fire managers, specifically fire management officers throughout the Forest Service. We included not just senior fire management officers, but also AFMOs and others. Our initial survey, about 650, we had a response rate where we had about 180, go through the complete survey and provide detailed enough answers that we could use them in our analysis. So that's an adjusted response rate of somewhere between 20 and 30%. This survey was partially just individuals giving answers to questions that weren't experimental. But there was also an embedded experiment. Individuals were randomly assigned to conditions. I mentioned earlier that one of the key parts of it was that we focused on that transition from initial to extended attack. Respondents were randomly assigned to the baseline condition, effectively what the initial team had been doing. Either the initial team was directly attacking the fire and respondents now had to choose whether they were going to indirectly attack or in the other condition, it was the exact opposite. The first team had decided to indirectly attack the fire and now that that individual was arriving, they had to decide whether they were going to switch to direct attack. And it's that experimental manipulation is where those framing effects that Matt talked about come into play.

Bob Keane: So Matt, were there great differences between the type of fire manager or just individuals in any way?

Matt Jolly: I feel like that the team that would work really hard to get a good spectrum of decision makers at a range of different levels that have experience from years to decades. So it's been quite a good gap of respondents. You know, the important thing to is really thinking about how confident those decision makers were in particular things. So focusing on how confident they were on the actual accuracy of a wind forecast or precipitation forecast, and how that bled back into, or fed back into the decisions that they're going to make specifically this transition from direct or indirect attack. And really, it was a challenge to frame this up initially, because these kinds of decisions are so diverse, and really kind of getting the scenario itself framed out and something that could be tested with a choice experiment, something that we could feed weather and modeling information into so that we could test these things was really one of the challenges too. So essentially, putting those sideboards on the kind of questions that get asked and then trying to tease out like, how confident are they? How important is certainty in a forecast, and then how those things are very dependent on the initial decisions that are made. And I know Claire can follow up a little bit on that as well.

Bob Keane: So Claire, which of the weather parameters are the most confident in?

Claire Rapp: So we measured four different kinds of forecasts. We measured precipitation forecast, humidity forecast, wind, and then general. And what we found was that respondents typically had higher evaluations of forecasts, quote unquote, in general, and humidity forecasts. They had lower confidence in precipitation forecasts and wind forecasts. This is interesting, these differences between confidence were generally pretty small. We measured our variable in such a way that we didn't ask people, you know, give us a specific number,

because we have good reason to believe that that number would kind of be very feelings-based and a little arbitrary. So instead, we provided them ranges. And across all four kinds of weather models, people typically believe they were accurate 51 to 75% of the time. But they were generally less confident in wind and precipitation models. And this is interesting because of the models they were less confident in. But wind and precipitation models were more important in their decision making in our choice experiment than humidity.

Bob Keane: Very interesting. Matt, what do we do with this information now that we know it? How can we get rid of this cognitive bias?

Matt Jolly: I think there's a cognitive bias in the level of confidence in the forecast themselves. So Claire can talk about the implications for the actual future of decision support systems. But there is a future here also for informing things like National Weather Service forecasts. So let's say hey, look, if you're going to focus on anything, focusing on increasing the confidence of near term precipitation, near term when forecasts makes the most sense. And it's supported by the fact that it does have this sort of low level of confidence for decision making, but we know how important things like wind speed is for fire behavior. So, so really thinking about how to leverage this information to feed back to the National Weather Service and say, look, we'd really love it if you could focus on these variables and help increase the confidence in these variables with the field so that we can rely on them more heavily for decision making. But there are also some other implications, especially for the framing piece that I think Claire can follow up on.

Bob Keane: Claire, do you want to follow up on that?

Claire Rapp: Absolutely. I also want to quickly point out, Matt is absolutely right, that the results of this speak to what weather forecast components are most prime for improving confidence. But I also want to point out that improving confidence kind of has two forks to that. On one hand, there is increasing the actual reliability and accuracy of the models, which is absolutely important. But on the other hand, there's also the human factor. How do you after you improve model reliability or accuracy make people more confident in them? How do you get them to internalize that improvement in those models, and effectively accept that the models are better and change their decision making accordingly? And I think that's particularly interesting because those are two very different questions. One of those is a question of how we predict and how we build models. And the other is a question of how do we change human behavior and human attitudes? As far as the framing piece goes, what was interesting about that is that effectively how important a given piece of information was, not just how they used it and how they interpreted that information, but how important it was dependent on that experimental condition that they were assigned to that I talked about earlier. In particular, it may seem that whether you're deciding to switch from direct attack to indirect attack, or whether you're switching from indirect to direct, regardless, things like precipitation and wind should be equally important. But we didn't necessarily find that was the case. They had the same effect sizes, you know, people prefer to indirect attack when weather suggested extreme fire behavior, and preferred to directly attack when it suggested more moderate fire behavior. But we also saw that how important they precipitation versus wind was depended on that experimental condition. And this is important because it suggests that a given piece of weather information is not going to be interpreted the same way and given the same importance across different fires, across different fire managers, or even across different things like weather, the wording is slightly changed in how that information is presented to them. Now, there's a lot of implications for when we try to ask questions about how are people using this information? How do we give people information in the best way possible? And how can we tell what impact this information is having on the ultimate decisions that they make?

Bob Keane: Wow, that is incredibly interesting, the complexity of it. And I invite all our listeners to read the paper and get all the amazing insight that Claire and Matt have to offer into this cognitive bias and so on. I want to thank you both for appearing on the podcast and for submitting your paper to Fire Ecology. We'd like to end with Matt, you got any funding sources that you'd like to acknowledge?

Matt Jolly: This project was funded by the Joint Fire Science Program and from a grant that we received actually several years ago, and it's the culmination of that work. And I'd also just like to say, what a pleasure it's been to work with Ohio State on this project. It has been a good learning experience for me being mostly a modeler and a weather person to really focus in on this sort of decision-making aspect too. So just thanks to Joint Fire Science and to Ohio State. Robyn Wilson and Eric Toman from Ohio State as well. They've been an integral part of the team. They've been great mentors for Claire at the university. And as well as for me, helping me understand a lot of things that are brand new for me. So just appreciate working with this entire Ohio State team from Claire, Robyn, and Eric.

Bob Keane: Thank you, Matt. Claire, what about you? Do you have anyone want to acknowledge?

Claire Rapp: I also like to thank Joint Fire Science Program for providing the funding for this research. This has been an amazing project to work on. I'd also like to thank the Forest Service and Matt Jolly specifically, kind of the opposite experience that Matt Jolly has had because I'm a social scientist, I knew very little about wildfire going into this kind of big, overarching, multiyear project. And I'm very grateful for all of the patience and mentorship and help that I have received over the years as I've come into this arena, and ultimately been able to develop my expertise, and develop my scientific skill set to be able to make a paper like this. So I would just like to thank everyone who has been part of my academic journey so far.

Bob Keane: Again, thank you, Matt and Claire. We really appreciate it. You listeners, if this really interested you, please download the paper from the *Fire Ecology* website. It’s free. It's all yours. Thank you again, and we'll see you for the next Fire Ecology Chat.