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

Transcript of Episode 19 - Decoupling between soil moisture and biomass drives seasonal variations in live fuel moisture across co-occurring plant functional types

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Bob Keane: Good morning everybody. My name is Bob Keane. I am the Editor of the journal called *Fire Ecology*, which is sponsored by the Association for Fire Ecology. We do podcasts and each podcast is for a particular paper that we feel is pretty important. This paper that we're going to talk about today is no exception. The paper is *Decoupling between soil moisture and biomass drives seasonal variations in live fuel moisture across co-occurring plant functional types*. And we have the senior author here today, Tegan Brown. Could you go ahead and introduce yourself Tegan?

Tegan Brown: Thanks, Bob. My name is Tegan Brown. I'm an ORISE postdoctoral research fellow at the Missoula Fire Sciences Laboratory of the Rocky Mountain Research Station, the US Forest Service. I did this paper during my PhD at the University of Melbourne, Australia in the School of Ecosystem and Forest Sciences.

Bob Keane: Wonderful. And why don't you go ahead and give us the elevator speech about this paper? What is this paper about? And why should we read it?

Tegan Brown: Sure. So this paper really digs into the drivers of seasonal fluctuations in live fuel moisture content. And we looked at that across three plant functional types that are common to Western Montana. But I think (they) are pretty common across a lot of different forests in the US and then also, you know, across the world. So we looked at a herbaceous groundcover plant, an understory shrub, and an overstory tree species. And overall, our aim was to understand whether the changes in their access to water or changes in the foliage biomass were having a bigger impact on seasonal fluctuations in live fuel moisture content. So overall, better understand seasonal differences in live fuel moisture content across the landscape.

Bob Keane: Yeah, and this is really important. One of your co-authors, Matt Jolly, has been pounding my head with this for a while. And finally, I am convinced it's not only the moisture that makes a difference, it is the amount of biomass that really explains the moisture content that influences fire behavior. So could you describe how you went about this study?

Tegan Brown: Yeah, for sure. And you're absolutely right, Bob. You know live plants are growing, so the live fuel moisture content equation, as I'm sure most of the listeners know, is a relative equation of water mass to dry mass. And in dead fuels that dry mass isn't really changing much. But in live fuels, of course, they're growing and they change both seasonally and across different years. So that was one of the key factors in designing this research. And yeah, so to look at the methods, we had six field sites in the Lubrecht Experimental Forest, which

is an experimental forest in Montana, that's run by the University of Montana. And I'm really grateful to Zach Hoylman, who actually set up these sites as part of his PhD project. And I was able to kind of come in later and use some of the sites that are set across the north-south aspect gradients and an elevation gradient. We sampled plants across the summer at those six sites to look at how do the site conditions versus how do the biomass changes in the plant influence live fuel moisture content.

Bob Keane: Okay, in the end, what did you actually find?

Tegan Brown: So we found that soil moisture and changes in biomass was significant drivers of the seasonal differences in live fuel moisture content for all three plant functional types. But we found really interesting differences in the magnitude of importance of each factor, and also in the direction, that is whether they were sort of pushing live fuel moisture content up or down between the different plants. So we found trees quite different just sort of herbs and shrubs in that context. The changes in the moisture content of tree needles was much more related to seasonal changes in the biomass, and not that strongly related to site conditions like soil moisture or anything else at the site that we could measure. And, you know, in contrast to that, that herbaceous ground cover functional type was much more strongly related to changes in its access to water, rather than any kind of seasonal or phenological changes in the biomass of the plant.

Bob Keane: Yeah, I think one thing that sets this paper apart is you very intelligently put together a conceptual model that shows what is important to this whole idea of live fuel moisture and what really matters. I'm gonna tease the reader that they should really go to the paper and actually see this model, but could you describe it just a little?

Tegan Brown: Sure, thanks Bob. Yeah, this is something that Matt and I talked about a lot together on this paper, growing a lot of the literature into a bit of a conceptual model that makes it a bit easier to understand what we're talking about because it is super complicated sort of stuff. And I have to give a shout out to Elliot Conrad, one of the co-authors who did the beautiful artwork on the conceptual model. But what we're sort of looking at is a figure of we've got a tree shrub to herb on a little you know, horizontally, and then we're looking at whether those coupled or decoupled from the site. And then, at the bottom of the figure, we've got a little, I guess a sliding scale of whether the soil moisture or the leaf mass area, which we use as a proxy for the biomass or the dry, dry matter in the plant is having a bigger impact on live fuel moisture content. So for trees, it's much more related to the biomass of the needle. Whereas the herb much other herbaceous ground cover plant much more related to the volumetric water content of the soil.

Bob Keane: Yeah, I just think of all the studies and applications that use site conditions to predict live fuel moisture content, and yet your model clearly shows that we probably shouldn't do it, we really have to look at life form, don't we?

Tegan Brown: Yeah, yeah, exactly. And, you know, there might be some plant functional types, were looking at the site conditions, or, you know, this kind of seasonal conditions is really helpful, particularly for that herb and shrub where they're quite connected to the site that they're located at. But we've found for trees that only 8% of the changes in live fuel moisture content could be related to site conditions. Most of the differences were related to the sort of tree itself and biomass and the sort of seasonal changes that it just goes through naturally, it didn't really relate to the site conditions very strongly at all.

Bob Keane: That's amazing. Thank you, Tegan for this wonderful paper. If you use live fuel moisture content, you should read this paper, it's of course on the Fire Ecology website. Tegan, at this time, do you want to recognize any other people or institutions that funded you?

Tegan Brown: Yeah, I really want to thank the co-authors. I came over to Montana as part of my PhD and was just here for four months. So having all of them really helped me get this paper going. I also have to thank the Australian Government for funding my PhD stipend and Melbourne Water and also Forestry Australia, which is a an organization of forest scientists in Australia who also supported me to come over here in 2019 to do this field work. Thank you.

Bob Keane: Thanks again, Tegan and so long.