

Reviewer 1

I was convinced by the clarifications and improvements done by the authors, with one exception: meso-scale weather versus the weather actually driving fire behavior, namely wind speed. The authors state, without presenting the data, that they were consistent with assessments at the fires, which is vague. Given the objectives and context of the study I won't be picky about this.

AR: We appreciate the reviewers' consideration of the study objectives and disinclination to be picky about remaining points.

Reviewer 2

Please see the attached document. In it, my comments on the original manuscript are in black, the authors' responses are in green, and my new comments are in red. I used this format because the authors' revisions were not sufficient to make the manuscript acceptable, in my opinion.

The authors did not make adequate revisions in response to my concerns to make the new manuscript acceptable as is. I encourage them to take time in making new revisions, as some revisions came across as very careless.

AR: We trust the reviewer will find these comments more thoroughly attended to in this revision.

INTRODUCTION

First paragraph would benefit from clear statement of link between “prescribed fire” and “wildland fire”. Also, the introduction reads like a textbook until the second-to-last paragraph. State in the first paragraph where you’re going with all this terminology – lack of information for the Northern Great Plains (NGP) and why it’s needed. Although the title and abstract indicate that this paper is about grasslands, some terms used in the Introduction would make more sense if its stated up front that all this information is about grassland wildland fire.

AR: We've reconstructed the first sentence to clarify that Rx fire is used for the management of fire-dependent wildland ecosystems. The reviewer's comment about a textbook is confusing—as the author of a textbook on wildland fire, I initially took this as a compliment, although the tone of the comment suggests it isn't meant to be positive feedback? It is unclear what the role of the Introduction of a scientific paper ought to be in the reviewer's mind. It is also unclear what specificity about grasslands would add to comprehension—very few, if any, of the factors described that affect the wildland fire environment are ecosystem-specific.

My comment about the introduction reading like a textbook was intended to inspire the authors to make the opening paragraph more informative to the reader. Yes, the purpose of an introduction to a scientific paper is to provide background information, but it is also to make sure the reader knows what the background is for. I reiterate that the first paragraph – and the rest of this introduction – needs to make clear why all of this textbook information is presented. Especially important is greater care in pointing out how the factors that influence fire behavior differ between prescribed fire application and wildfire (e.g., comment regarding cured fuels below).

AR: We have added to the second line of the first paragraph the distinction between fire behavior objectives and attendant conditions for wildfire and prescribed fire contexts.

24: Greater fuel load is also attributable to vegetation composition, productivity of system (soil fertility, climate, etc.), time since/intensity of grazing, and a whole lot of other stuff.

AR: The reviewer is correct. However, none of this “stuff” are components of a fire regime, and have little relevance to a paper focused on fire behavior.

All of these factors are most definitely components of a fire regime because they influence fuel load at a given time and place. Just remove “attributable to longer time-since-fire” and this sentence will be acceptable.

AR: We have removed the phrase “attributable to longer time-since-fire” from this sentence to make it acceptable.

30-32: “highly-cured context of wildfire seasons”? See first comment – explanation of “curing” might be useful for some readers.

AR: We've addressed this point in consideration of both reviewers' feedback on this phrase.

The revision is a good attempt, but it's a bit ambiguous as to when fuels are often highly cured, outside wildfire seasons, or inside them. I suggest rewording to something like “Finally, while highly cured, uniformly low fuel moisture content in active wildfire seasons contributes to [faster rate of spread, greater energy release, etc.], fire behavior outside of these seasons, when prescribed fire is often applied, is often limited by high fuel moisture content.”

AR: We have adopted the reviewer's suggested sentence in its entirety.

63-66: Does rate of spread measure intensity or energy flux? If not, how does it make moot the third issue of temperature as a fire behavior metric? If so, make this connection clearer. This is critical given the emphasis on rate of spread in this manuscript.

AR: Temperature is made moot because it is not a variable that contributes to fire spread.

The authors missed the point of this comment. They say that measures of intensity or energy flux are biologically relevant. How is rate of spread more biologically relevant, in terms of energy flux or intensity, than temperature? Make this clear.

AR: The reviewer is correct in continuing to raise points about this paragraph. There was too much going on in the delineation of three weaknesses of thermocouples. We've substantially re-written this paragraph and the one above it to focus less on listing the inadequacies of thermocouples. We have collapsed this discussion into a single paragraph that seeks to highlight the innovative approach of using standard thermocouples to calculate a better metric (rate of spread), than bashing temperature.

76-78: Do the papers cited in this paragraph test the effect of fuel beds on fire behavior in the NGP? Mention of that would be nice here, given the emphasis on fuel in the title, abstract, and Introduction.

AR: No, they do not. Mention of this has been made.

Where has this been clearly stated? The first and last sentences of this paragraph say, “few data on rate of spread” and “few studies...on fire behavior”. What are those few studies? What do they say? If there are NONE, say so.

AR: To clearly state that there are, to our knowledge, no studies that deal with fuel AND weather on fire behavior, we have revised the line to say “To our knowledge, no studies on grassland fire in the northern Great Plains region has explicitly tested the effects of fuel moisture and fuel load, or fire weather, on fire behavior.”

METHODS

Consistency is needed in this section and throughout the manuscript in terms used for different scales of measurement. This becomes important in the results when it's unclear what scale is being referenced. For example, in the first paragraph of the “Data collection” subsection, the 1-m triangles seem to be referenced as both “plots” and “microplots”. Since all the data analysis and results seem to be using the 1-m data, stick with just one term. Unless there's something different between plots and microplots.

AR: The reviewer is quite correct and we appreciate attention having been brought to inconsistencies in references to microplots and plots. We've edited for clarity.

The edits in the Methods section are good, but the authors did not make appropriate edits in the Results section. The second paragraph in the Results section refers to sub-plots and plots, not microplots. When referring to plots, do they really mean microplots?

AR: We appreciate the attention to this detail and have sought to revise accordingly throughout the paper, not just in the Methods.

163: Why 15 cm? What is the biological or physical significance of that height?

AR: 15 cm is a common height, along with 10, 20, ..., and represented a good average of half of our fuel heights.

Explain this in the manuscript, not in the response to reviewers. Given that the authors criticize other studies for their emphasis on temperature without explaining its biological or physical significance, the authors should do better than those other studies by justifying their choice.

AR: We've added a sentence to the Methods explaining that we made our single observation at 15 cm because other papers have reported data from 10 and 20.

184, Figure 1, and elsewhere: Units need to be provided for VPD.

AR: OK. We've denoted that VPD is measured in hectoPascals (hPa), whatever that means!

Curious that the authors don't know what the units of their variable means.

AR: We apologize for not having a strong intuitive understanding of hectoPascals. Meters, Celsius, even rates of energy release are conceptually simple, but atmospheric pressure at the level of leaf stomata isn't quite as intuitive.

RESULTS

See comment above about “plots”, “subplots”, and “microplots”.

AR: It seems likely that edits made to the Results section eliminates most of the concern that lingered for the reviewer.

DISCUSSION

293-294: Confusing wording: Suggest changing to “...surface temperatures were 110 deg C and 165 deg C for backfires and headfires, respectively...”

AR: Good point, we've made this change.

Change (now in lines 307-308) made it even worse, “temperatures varied between for backing fires were 110 and headfires 165”.

AR: The reviewer's concern isn't clear, as the phrase quoted here is not how it appeared in the text. Regardless, we've revised the sentence again to try and lend better clarity to the distinctions made between fire types and observation levels.

358-359: Figure 1 shows ~25% of observations <60 deg C and <50% <100 deg C. If I'm interpreting Figure 1 incorrectly, the caption of Figure 1 needs modifying to make interpretation easier.

AR: Thank you, we've corrected these summary statistics.

Correction doesn't make sense, now stating that both 50% and 60% of observations were less than 100 deg C. When re-correcting, using biologically meaningful temperature thresholds, and explaining that biological meaning in this paragraph, would be useful. (100 C is relatable to biological meaning, and I'm pretty sure there's fire literature to support the 60 C threshold – cite that).

AR: We have removed the line in question, along with overly descriptive text in the Results that lingered from the original thesis draft. The multi-panel figure makes the text awkward and redundant. The Results section should now be more clear and focused on take-away points about the data, without being bogged down by textual description of them.