

Biogeosciences Discuss., referee comment RC3
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Comment on bg-2021-83

Anonymous Referee #3

Referee comment on "Reviews and syntheses: Arctic fire regimes and emissions in the 21st century" by Jessica L. McCarty et al., *Biogeosciences Discuss.*, <https://doi.org/10.5194/bg-2021-83-RC3>, 2021

Overall comments

In this manuscript, McCarty et al. aim to compile a comprehensive review of what is known about the controls on Arctic and peri-Arctic vegetation fire regimes, how changing climate and anthropogenic factors might influence fire and vegetation in the future, and what additional knowledge would be especially helpful for improving scientific understanding of such. The material the authors have brought together is extensive and varied, and would be more than appropriate for publication in *Biogeosciences* as it could be a valuable resource for many in the scientific community.

However, much work remains to be done on this manuscript to bring it up to a quality level appropriate for publication. Many assertions need to be more fully explained and/or justified, organization within sections needs to be overhauled, and various sentences need to be reworked for clarity. As such, I recommend that this manuscript be resubmitted with major revisions.

Specific comments

- L120-123: Information in this sentence doesn't support the conclusion of "highlighting the dependence of... fire on climate."
- L130-140: Should be in Sect. 3.
- L157: Explain to the reader how timber extraction and site preparation cause wildfires. What are people doing, exactly?
- L159-160: "Likely"? How much agreement is there about expansion? And how much fire is associated with cropland there?
- Organization of Sect. 3 needs to be rethought. "Natural fires" and "non-forest fires" are not mutually exclusive, and there are far too many topics within each of these. Consider sub-sections based instead on, e.g.: climate/weather, biogeography, insects, etc.
- L177-209: Most of these 8 topics (esp. 2, 3, 5, and 6) need to be expanded and more fully addressed. Each should have its own paragraph's worth of information.
- L199-201: Connect with or move to L169.
- Sect 3.1 title: Is *number* of fires really the thing we should care about? Isn't burned area more important?
- L214-221: Duplicated information from earlier.
- L226-227: Explain how transitioning from boreal to deciduous forest would decrease fire risk.
- L231-232: Shrubs might be "coniferous species," but lichens and mosses definitely are not.
- L234-235: "Likelihood of flammability" doesn't make sense. Likelihood of burning, maybe?
- L252: This sentence is so vague as to not convey any useful information. Either expand on what Reyer et al. (2017) said or remove this sentence.
- L258-260: Unclear how the two effects in this example are "opposite."
- L261-262: Explain how shortening soil frost period would lead to more wind damage.
- L285-299: Historical information should be in Sect. 2. Perhaps a "seasonality" subsection would make sense to include there.
- L294-295: Explain why widespread snow and sea ice make early-season fires "particularly relevant."
- L310-312: Duplicated information here re: use of active fire product in GFED4s.
- L378: Consider using a smaller unit (e.g., Mg) so values are easier to read.
- L394: Sect. 5 title needs to be reworked.
- L409-412: This analysis does not seem to have actually been included anywhere.
- L451: 60°N should be 65°N.
- L476: Is "allowing wildfires to burn under non-severe fire weather conditions" really "active" fuels management?
- L484-485: This bit about re-greening seems unconnected to the topic at hand. Or is it? Explain.
- L500-501: Incomplete sentence?
- L508-510: This sentence is trying to do too much. There are two separate ideas: when the cropland burning occurs, and when transport is likely. These should be separately explained, then brought back together to show that they coincide.
- L521: "particularly in the context of emissions reductions" feels disconnected from everything else. Please elaborate or remove.
- L533-552: This paragraph feels like it would make more sense in Sect. 3. Either move it there, or explain what exactly here is especially uncertain.
- L537: Missing words before "Important".
- L547: What does "Zonal" mean here?
- L554: What does it mean for a forest to "decrease"? Decrease in what way?
- L587-589: How can ESMs have a mis-estimate for a future period? By definition we do not have observations for the future against which to compare future ESM simulations.
- L634-635: 3.5 million cubic meters of permafrost what, exactly?
- 7.5: This section feels weird to me. It seems like the Russia records are being cast as

“bad” when they disagree with remote sensing data, but Finland and Norway records are “good” when they do. (See L700-701: GWIS “overestimates” burned area in Norway and Finland—couldn’t you also say that the official records *underestimate* burned area?) These judgments are not necessarily wrong, but they should be better justified.