

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-83

Anonymous Referee #1

Referee comment on "Reviews and syntheses: Arctic fire regimes and emissions in the 21st century" by Jessica L. McCarty et al., Biogeosciences Discuss.,
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General Comments

On the whole, this is a well-written review. It is centred around six policy-driven questions, which makes it relevant and useful, and it is usefully divided into several sections which makes it easy to reference and to digest. The main conclusions stated in the abstract are mostly clear, are relevant, and expand current knowledge, especially the new analysis showing how emissions have increased in Arctic regions since 2010. I appreciate the numbering which is intended to make things easier to follow, however, taken together, it is a little confusing to have 6 policy questions, 4 key objectives, 9 paper sections, and 6 conclusions, all of which are slightly different. I wonder if these can be made more consistent, or linked together more. There are also some sections that could benefit from some re-ordering, as outlined below.

The approach for the review and the analysis are valid, and the authors compare a number of datasets to draw the conclusions of their analysis of burned area and emissions. The presentation of the manuscript and figures is good, although some suggestions for improvement are shown below. Overall I believe the paper makes a good contribution to scientific progress.

Specific comments

Line 36 – the third conclusion is vague: "... transitions... may increase and decrease open biomass burning". Increase and decrease in different biomes? At different times? Please

clarify.

Lines 50 – 58. Nice start to the introduction, it's useful to have the aim of the paper stated up front in the introduction in a concise way. Line 52 states what other published reviews have done, but doesn't go on to say how this review differs or what new information is offered. It would be useful to include a sentence on this here.

Line 68 – “both earlier and later”, presumably this means both earlier start and later finish? Please clarify.

Line 114 – I think the definition of open biomass burning would fit better in section 1 where the other definitions are, e.g. in paragraph 3.

Line 181 – is this a conclusion of this study based on extrapolation from related literature, or is this part of the findings from Tchebakova et al 2009? Please clarify with a relevant reference.

Lines 175-209 – Figure 1 is useful, but the description of it could be clearer. Some of the conclusions in the text are not linked with increased or decreased fire, and it would make this paragraph clearer to explicitly state the direction of change, for example with the change to light-needled Larix in conclusion 5 it is not totally clear what the impact on fire risk would be and why. Can you also add an explanation for why boreal to deciduous would decrease fire risk. Is transition to forest-steppe just a result of increases in fire regimes (line 191) or also a cause of change in fire risk? There is some explanation of this in section 7.1 but it can be briefly referred to here.

Lines 195-209 – I think this would fit better as a separate paragraph. The 8 points in the previous lines clearly relate to Fig 1, but these additional lines are broader. It would also help to break down this very long paragraph.

Section 3 – paragraphs 1 and 3 are both about lengthening fire seasons, whereas paragraph 2 is about vegetation shifts. I would swap paragraphs 2 and 3 around for a more logical order.

Lines 244-246 – This relate to human management rather than climate change, not sure it fits in this section.

Line 342 – noting the dotted line as stated in the text, it looks like FINN shows a negative

trend, not positive.

Line 367 – is there a reference for the statement that Greenland is a novel fire regime in the Arctic? Table 2 only shows 1 year of data so we cannot tell if it is unusual from this.

Fig 2 – GFEDv4s data are now available to 2020. Can Fig 2 be extended to 2020 to match the later results?

Fig 7 – It would be better to have the global results on the left to match figures 4-6, and the description in the text.

Technical Corrections

Line 169 – Boike et al **showed that**

Line 402 – because it **was** produced

Line 537 – reword: “it is important to note that”, or “important to note is that”

Line 398 – reword: “explicitly considers environmental policies and assesses their impact”