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Interactive comment on "Fire intensity impacts on post-fire temperate coniferous forest net primary productivity" *by* Aaron M. Sparks et al.

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Overall response: We would like to thank referee #2 for the supportive comments on the manuscript. We plan to implement their suggestions in our revised manuscript. Below we respond to each of the comments individually.

Anonymous Referee #2 Received and published: 30 October 2017

This is an interesting paper detailing how NPP varies with fire severity across 15 large fires in the western U.S. MODIS satellite data at the 1-km pixel scale was used, giving a coarse view of fire severity effects on productivity. The paper addresses relevant scientific questions, presents novel results, and reaches substantial conclusions. However, some aspects of the paper, both major and minor, could be improved. General and specific comments follow.

General comments: 1. Freeborn et al. 2014 reported that differences in per-pixel FRP measured near simultaneously have a standard deviation of 27%, and that clumping pixels helps a lot (50-pixel aggregation reduces uncertainty to 5%; citation at end of comments). This seems like a relevant issue for the current study, since it uses pixel-level data. Would including the uncertainty in the analysis change the results or the interpretation of the results?

R1: We will discuss the potential impacts of this uncertainty in an expanded discussion section of the revised manuscript.

2. I don't find the conceptual framework (page 8 and Figure 4) to be very strong. The authors state that they are linking individual tree-level processes to fire intensity and forest growth and productivity. But they go on to say in the Limitations section that understory vegetation may recover rapidly and make it appear that the overstory recovers rapidly. It doesn't seem that the authors can actually say much about individual tree mortality, given the heterogeneity of fires on the ground, the large size of the pixels being used, and the lack of on-the-ground severity measurements. Couldn't it be that shrubs are what are responding post-fire rather than trees?

R2: Sparks et al. 2016 and Smith et al. 2017 observed mechanistic links between FRP and sapling mortality and productivity. These, and other studies (e.g. Sparks et al. 2017), also collectively demonstrated that the mechanism scaled from the saplings in a laboratory fire to mature trees in stand-scale fires. Prior studies (Ryan and Reinhardt 1988; Hood et al. 2007) had previously reported similar relationships between proxies of fire intensity and mature tree mortality. Although the current paper suggests that this may further scale from the watershed to the regional scale, we agree that this is not yet proven. As such, we will adjust the text to be more circumspect and cautious of a regional scale relationship.

3. Finally, I agree with the first reviewer in questioning why the authors grouped the

FRP and FRE into percentile classes, because then it's difficult to compare actual FRP and FRE in terms of their effect on NPP across fires- you've limited the analysis to within fire differences. Similarly, I also question why relative NPP rather than absolute NPP is shown in the supplemental figures. Are there are interesting absolute differences among forest types?

R3: This section was poorly worded and will be clarified in a revision. Percentile classes were based on absolute magnitude by forest type, not for each individual fire.

Specific comments: 4. Page 4, Line 1: MTBS only includes fires 1000 acres and bigger: are the authors able to verify through other data sources that these areas haven't burned since 1984? Does it matter?

R4: This is a great point. We mapped smaller burned areas within each MTBS polygon using the Normalized Burn Ratio Thermal Index (Holden et al. 2005) computed by Google Climate Engine (climateengine.org) annually from 1984 to the present. Google Climate Engine uses data from Landsat 4, 5, 7, and 8 depending on availability and cloud cover to produce 30 m spatial resolution datasets. Using these data we found that, on average, less than 1.5% of the MTBS polygon area burned between 1984 and the year that each fire burned. We will include this information for each fire in the proposed table (comment #6) in a revised manuscript.

5. Page 4, MODIS datasets: Was FRP available for all pixels inside the MTBS perimeters?

R5: On average, FRP data was available for >88% of the area within MTBS perimeters. We will add this information for each fire into the new table proposed in comment #6.

6. Page 5, section 3.1: All of the numbers in this paragraph could go into a table and it might be easier to read.

R6: Thanks for the suggestion, we will add these into a new table.

7. Page 5, Line 7: It's mentioned here that other things besides fire may contribute

to NPP variability, but I don't think it was mentioned again. It's worth noting in the discussion whether climate or other factors might play a role in post-fire recovery of NPP.

R7: This is a good point – we will add some text in the discussion that addresses these factors.

Technical Corrections: 8. Page 3, Line 12: Some of the sites are not in the Northern Rocky Mountains.

R8: This will be re-worded in the revised manuscript.

9. Page 3, Lines 19-24: Pick past or present tense to be consistent throughout.

R9: This will be corrected in the revised manuscript.

10. Page 3, Line 26: "Canopy cover for each fire"- do you mean pre-fire canopy cover?

R10: This will be clarified in the revised manuscript.

Citation: Freeborn, P.H. M.J. Wooster, D.P. Roy, and M.A. Cochrane. 2014. Quantification of MODIS fire radiative power (FRP) measurement uncertainty for use in satellite based active fire characterization and biomass burning estimation. Geophysical Research Letters 41(6):1988-1994.

Response references: Hood SM, McHugh CW, Ryan KC, Reinhardt E, Smith SL (2007) Evaluation of a post-fire tree mortality model for western USA conifers. International Journal of Wildland Fire 16(6), 679–689. doi:10.1071/ WF06122.

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