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Interactive comment on "Quantifying regional, time-varying effects of cropland and pasture on vegetation fire" *by* S. S. Rabin et al.

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We thank Referee 1 for the valuable comments and suggestions. Our responses to each point follow. (Please note that we plan to convert our Appendix to a Supplement.)

1. In page 10820 line 12: you mention that some authors highlighted that human influence as a function of human population density are poorly explained and you aknowledge the work of Prentice et al., 2010. However, Prentice et al., did not show that with a data driven analysis. In my opinion work like: [Knorr, W., Kaminski, T., Arneth, a., & Weber, U. (2014). Impact of human population density on fire frequency at the global scale. Biogeosciences, 11, 1085-1102] and [Bistinas, I., Oom, D., Sa, A. C. L., Harrison, S. P., Prentice, I. C., & Pereira, J. M. C. (2013). Relationships between

human population density and burned area at continental and global scales. PLoS ONE, 8] should be acknowledged. The first study shows a non-linear model estimating the effect of population density on burnt area at global scale. The second study (and very relevant to the current paper) highlights that the effect of population density on fires in fact a function of land use changes and considers the agriculture being two of them.

Bistinas et al. (2013) is indeed extremely relevant and we thank the referee for bringing it to our attention. We will replace the citation of Prentice et al. (2011) with these two articles.

2. Page 10824, line 16: Why not using GFED4 for that study? The native resolution of GFED4 is 0.25°, but GFED3 is at 0.5°. However, from the description you make, it looks like it's a typing error and that you indeed used the 4th version. If not, I would totally recommend to update your calculations.

While GFED3 is distributed at 0.5° resolution, the underlying algorithm actually produces raw data at a much finer resolution. In producing GFED3s, Randerson et al. (2012) appear to have decided that the benefit of distributing the data at 0.25° outweighs any additional infrastructure costs (e.g., server space, bandwidth). We chose GFED3s rather than GFED4 because GFED3s focused specifically on capturing burned area and emissions from small fires, which we hypothesized would be especially important for agricultural burning.

3. Page 10827, line 1: You write that "Fuel load should be higher on average for non-agricultural lands than for pasture because pastures do not have trees in densities comparable to more carbon-rich forest ecosystems." That is not entirely correct as in pastures, the low vegetation has high postfire regeneration and can be prone to more than one fire events. Especially in savanna biomes.

We agree that the high frequency of fire in savanna could lead to higher average annual emissions there than in a higher-biomass but less-burned ecosystem. However, this difference is in total fuel *consumption*, not fuel *load* or fuel consumption/emissions *per area burned*. Fuel load is simply the amount of fuel available to burn at any given time. Fuel consumption in a savanna would indeed be higher if it were to burn twice, but its emissions per area burned are a function of fuel load only. van der Werf et al. (2010), in the paper analyzing GFED3 fire emissions estimates, agree:

> Fuel consumption (reported here as gC per m^2 of area burned) broadly followed biome distributions with low biomass density biomes such as grasslands and savannas burning less fuel than high biomass density types such as forests.

We will thus add a citation of van der Werf et al. (2010) to the end of the sentence you quoted to support this idea.

4. Page 10827, line 13: How well they reproduce the patterns? Please provide some metrics at this point already.

We will add a figure to the Supplement illustrating the results with regard to total fire in GFED regions, in the same style as Figure 8a. We will also discuss the statistics (linear regression slope, intercept, and Pearson's r) at this point to illustrate how close to the 1:1 line the points lie.

5. Figure 4: besides mean annual burnt area, the most intuitive way to show your results here would be seasonal means for December-January-February and so on (MAM, JJA, SON).

We will add maps of seasonal means to the Supplement.