Biogeosciences Discuss., 10, C6028–C6030, 2013
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Biogeosciences Discussions
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Interactive comment on "Impact of human population density on fire frequency at the global scale" *by* W. Knorr et al.

Anonymous Referee #1

Received and published: 9 December 2013

The paper is well written and concise, and the subject is timely with fire being increasingly appreciated as important for ecosystem dynamics and climate change and thus being included in DGVM's. Unfortunately I cannot comment on the optimization procedure but judging from the text where they highlight most issues and given their track record I trust the authors have done a good job in doing this carefully. I do have one major concern about the outcome of this study though which I hope the authors can comment on during the discussion phase of this paper.

My main concern is related to the message that 'at the global scale, the impact of increasing population density is mainly to reduce fire frequency'. I think there is enough evidence that this is true and the authors cite the available literature in this, but given their results one could argue that population density and fire frequency are actually

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only very weakly related on a global scale.

Population density increased over 600% from 1800 to 2005 while according to their results fire frequency decreased by about 15%. That indicates very low sensitivity given that population increases were substantial in high fire zones. In addition to this low sensitivity, human land use often leads to smaller fires which are more difficult to detect by the burned area datasets the authors use. This is especially the case in agricultural regions (which are masked out) but also in areas undergoing deforestation many fires remain undetected by the burned area algorithms. The global importance of these 'small fires' is not well known but estimated to be about 35% with substantial uncertainty (see DOI: 10.1029/2012JG002128). Given the new paradigm supported by the authors that more humans means fewer and smaller fires one can argue that these small fires gained importance over time, offsetting part of the 15% decline predicted by the model. This would mean global fire activity is even less sensitive to population density.

In other words, the most interesting conclusions for the community (more people equals fewer fires) are not supported quantitatively. I would appreciate if the authors use the discussion phase to clarify this. As mentioned by the authors, very low population density yields higher fire frequency than no population at all so the above could be the result of offsets between areas moving from being uninhabited to having low population (increasing fire frequency) and areas with low population density becoming more inhabited (decreasing fire frequency). Or are there other reasons?

In any case, I would be careful with extrapolating the results found by the authors back in time given that fires are influenced by multiple other factors besides population density. For example, Fig. 7 looks totally different from the pattern derived from charcoal data referenced in the paper (DOI:10.1038/Ngeo313) yet there is no discussion about the causes of this discrepancy. I would either refrain from simple extrapolation (and focus on population density as one of the factors driving fire frequency) or keep the extrapolation in there but make it very clear that this is solely a response due to changing

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population and only valid of all other factors would be constant which we know they are not. This option does require a much larger chunk of text explaining differences between the simple extrapolation and results from other studies including ice cores and charcoal data.

Interactive comment on Biogeosciences Discuss., 10, 15735, 2013.