Review of "Wildfire air pollution hazard during the 21st century," by Knorr et al.

In this paper, the authors use a dynamic vegetation model to probe the response of global wildfires to changes in climate and the CO_2 content of the atmosphere. While warmer temperatures from climate change will likely lead to increased wildfire activity in much of the world, increasing CO_2 concentrations could affect vegetation in ways that could diminish that activity. The paper also seeks to compare future concentrations of wildfire $PM_{2.5}$ to those of anthropogenic $PM_{2.5}$, and in some places the authors find that wildfire emissions will dominate pollution sources. The paper further compares the trends of future wildfire emissions and area at different population densities.

The main update from the first version of this paper seems to be the use of chemistry model to represent concentrations of $PM_{2.5}$ in the present-day and future (2090s) atmosphere.

The key points of the paper seem to be as follows:

A. Present-day wildfires in some developing countries are greatest in regions of intermediate density (1-100 people km^{-2}).

B. Under some scenarios, the CO_2 fertilization effect increases shrub, and so there is less fire. This appears to matter most in Sub-Saharan Africa.

C. In the slow-urbanization scenario in some regions – e.g., Australia – more people move into fire-prone areas and so more people are exposed to greater fire emissions.

D. In the Maximum Feasible Reduction scenario, in which anthropogenic emissions decline the most, wildfires emissions will dominate over anthropogenic emissions in many regions, especially in China and Southeast Asia, and parts of Africa and South America

Main points.

1. The paper is very difficult to read, and discerning the main points is challenging. Much of the paper rambles, and the assistance of a really good editor is needed. The use of cumbersome acronyms is especially confusing – e.g., one scenario is called CLE/SSP5/RCP8.5, and another one is called MFR/SSP5/RCP8.5.

2. The main goal of the paper appears to be to determine whether wildfires will affect our ability to meet WHO air quality guidelines. But it's very difficult to determine from the current set of figures where wildfires would pose such a challenge. See points #3 and #4.

3. The figures contain more information than is needed, obscuring the main points. For example, it appears we are meant to compare the dashed lines in Figures 3 and 4. These lines represent wildfire emissions for different timeslices at different population densities in different regions for different scenarios. But these differences across cases seem very small on the page, and are nearly nonexistent in some cases. The use of log-scales makes it even more difficult to compare fire activity across regions, and the very tiny values in some regions (e.g., the Middle East) seem

not worth showing. In well-composed figures, the main messages pop out at the reader, but that doesn't happen here. The plots should be carefully designed to illustrate the main points of the paper. More detailed plots should be relegated to the Supplement.

4. More issues with figures. The plots show annual emissions of $PM_{2.5}$, but of course wildfire has strong seasonal peaks. In this way, the plots are misleading. Also misleading is the apparent neglect of secondary organic aerosol (SOA) from biogenic emissions. By showing only emissions, Figure 1 implies that $PM_{2.5}$ in the Amazon and the Southeast US is anthropogenic, but of course SOA dominates the aerosol burden in these regions. And SOA is expected to increase in the future atmosphere, due to the impact of rising temperatures on biogenic emissions. There is also inadequate treatment of dust. Figure 5 shows total $PM_{2.5}$ and so it's unclear to what extent wildfires drive these concentrations.

5. Perhaps the authors should just focus on a few key regions (or better subregions) and show not annual emissions but fire season concentrations for the present-day and 2090s at different population densities. The contributions of wildfires to total $PM_{2.5}$ should be clearly denoted.

6. The paper does not sufficiently reference previous papers – e.g., Pechony and Shindell (2010). This reviewer asked for this reference in the first review. Also, it is not true that wildfires will increase everywhere in the future climate: Yue et al. (2015) shows decreasing fires in the future climate in parts of Canada.