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Interactive comment on "Soil fertility controls soil–atmosphere carbon dioxide and methane fluxes in a tropical landscape converted from lowland forest to rubber and oil palm plantations" *by* E. Hassler et al.

Anonymous Referee #1

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GENERAL COMMENTS Oil palm is one of the most rapidly expanding and financially important cropping systems in the tropics, yet little is known or understood about the biogeochemistry of these ecosystems, or their ability to release or sequester carbon. The work presented here is therefore interesting, important and novel because it provides much-needed, high quality empirical data on the fluxes of carbon from representative systems in the Southeast Asia region, over an annual cycle. This manuscript distinguishes itself from many of the other papers that have preceded it, because the

sampling is more spatially extensive and over a longer time period than other work, enabling the investigators to make more confident assertions about the annual fluxes of CO2 and CH4 from these systems.

The findings from this work will provide an excellent basis for understanding the mechanistic controls on CO2 and CH4 fluxes from oil palm systems planted on mineral soils, with the potential for future modelling or up-scaling. The focus on smallholder systems is also noteworthy, because smallholder cultivation typically accounts for 40-60 % of all plantations in Southeast Asia, and therefore represents a sizeable proportion of land cover under this cropping system. Studies on smallholder systems are also less common, and therefore this study serves as a useful point of comparison compared to measurements from large, corporate plantations.

However, one of the obvious scientific challenges for this study is the fact that smallholder management tends to be more heterogeneous than that of large agribusinesses (e.g. see page 7 line 22 – page 8 line 9). Yet despite this constraint, I believe that this dataset is still easily interpretable, given the selection of adequate controls (i.e. forest, jungle rubber) and the concomitant measurement of continuous independent variables (e.g. available N, P, soil texture, temperature, moisture, etc.). In addition, the use of small-scale manipulative field experiments, such as the simulated fertiliser addition study, helped to more unambiguously establish the mechanistic links between the fluxes and measured environmental variables.

My only other comment/minor concern is with respect to the content and organisation of the Discussion; while the authors do a good job of comparing their findings against the existing literature, I felt that the paper could be made more impactful if the authors made it clearer in the Discussion which of their findings was novel or interesting. As it is written, it is sometimes difficult for the reader to identify the most exciting results from this study. The Discussion could also be slightly streamlined in terms of length, or slightly re-packaged/revised to better highlight the most important findings.

Specific comments on individual portions of the text are provided in the section below.

SPECIFIC COMMENTS 1. Page 9, line 14: Were any of the CO2 or CH4 data non-linear? If so, how were these data dealt with?

2. Page 13, lines 25: Please revise this sentence, as the structure is a bit awkward and the sentence does not read smoothly.

3. Page 22, lines 19-29: As the authors allude, one cause for the reduced soil respiration fluxes in oil palm system may be because of lower root respiration in the oil palm system relative to the forest due to lower overall root biomass. Do the authors know if the oil palm systems had lower root biomass than their other ecosystems? Could they use data from spatially explicit sampling (e.g. sampling in gradients away from palms/trees; see page 13 lines 19-28) to estimate root versus heterotrophic (saprotrophic) respiration? I realise that this would be a back-of-the-envelope calculation, but it may be a useful point of discussion, given that the spaces between palms in many plantations have very sparse plant cover (and therefore could be used to estimate the root-free rate of soil respiration).

Interactive comment on Biogeosciences Discuss., 12, 9163, 2015.