

# ***Interactive comment on “Global and regional phosphorus budgets in agricultural systems and their implications for phosphorus-use efficiency” by Fei Lun et al.***

## **Anonymous Referee #1**

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The authors have done a lot of calculation and the paper presented a lot of good data. However, the paper lack of a very clear narrative storyline. The important results were hidden in a lot of data. The authors also lack deep analysis of the model results. It is very difficult for the audiences to identify the most important conclusions and explore the story behind the data. It will be good if the authors can reorganize the text a little bit and highlight the most important results and conclusions. Some specific comments are below:

1. P4 Line 74-79 “Previous research mainly focused on cropland while P fluxes in pasture and livestock production systems received less attention (McDowell and Condron,

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2004)”. This sentence is not precise and was supported by a literature in 2004 (more than 10 years ago). Actually there are a lot of studies including pasture and livestock production and the terms “agriculture” and “food production system” also include livestock production system in most cases (please see selected reference blow). With the diet change, more attention is attracted to the livestock production system. The logic of the long sentence needs to be further clarified. Do the authors mean “the differences in methodologies, system boundaries, and data sources hamper the assessment of (or make it difficult to assess) PUE”?

Reference Bai ZH, Ma L, Oenema O, et al. 2013. Nitrogen and phosphorus use efficiencies in dairy production in China. *Journal of Environmental Quality*, 42:990-1001. Cordell D, Drangert J-O, White S. 2009. The story of phosphorus: Global food security and food for thought. *Global Environmental Change*, 19:292-305. Ma L, Wang FH, Zhang WF, et al. 2013. Environmental assessment of management options for nutrient flows in the food chain in China. *Environmental Science and Technology*, 47:7260-7268. Liu Y, Villalba G, Ayres R U, et al. 2008. Global phosphorus flows and environmental impacts from a consumption perspective. *Journal of Industrial Ecology*, 12(2):229-247.

2. There are some problems in the Figure 1 (P6). The biggest problem is that the Human system should not be part of agricultural system. Detergent is not only for agriculture. There are some industrial uses for P, although the fraction is small. Most sludge is produced from urban life and should be in the agricultural system either.

3. The authors used fertilizer for chemical fertilizer, which is not appropriate and will raise a lot of confusions. The term fertilizer includes all kinds of nutrient used into the soil including organic fertilizer. In P6, figure 1, the fertilizer box should be chemical fertilizer. In P9, Line199-201. The dependency indicator can be the ratio of imported chemical fertilizer to the P in all chemical fertilizer or all fertilizer, which both make sense but have different policy implications.

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4. Table SI-2. The authors need to polish the crop categories. There are some inappropriate sorting and overlaps for different types of crops. For example the maize and the silage (maize) have overlaps. Popcorn, to my understanding, is the processed maize, but the authors sort it into other cereal.

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