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Interactive comment on "Management-intensive Grazing Affects Soil Health" *by* Casey Shawver et al.

Casey Shawver et al.

jim.ippolito@colostate.edu

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Anonymous Referee #2 Received and published: 13 March 2020

The manuscript is dealing with the question if land-use-change from crop to pasture would affect the soil properties. The manuscript is general well written however, there are three major concerns I have with the presented results: i) very short-term effects (only 1-2 year after LUC) are discussed, Authors Reply: We addressed this comment as reviewer #1's first comment dealt with this issue as well. ii) no control treatment (e.g. no grazing)

Authors Reply: Good point. We did not include a control, but would a rancher ever include a control? No they would not. We tried to set this project up as practical as

possible because 1) it was a short-term funded research project, and 2) the forage was used to feed the Colorado State University beef cattle on the research site. Every parcel of ground was asked to be used.

iii) no randomized established replicates.

Authors Reply: We really couldn't set up this set as suggested by the reviewer, because there was soil variability across the site. Combining soil variability with fencing to separate paddocks for MiG was nearly impossible given the site configuration/dynamics. Thus why we sampled only the major, similar soil series on-site within each of the four forages under MiG. Basically, this site was impossible to set up as a traditional, say RCB with four replicates due to extreme on-site variability. We chose to soil sample only the major soil series within each of the four forage treatments in order to reduce that variability.

Moreover, there was a lot of effort spent to introduce the different forage mixtures but results of this factor are either discussed very extensively or are not present.

Authors Reply: The forage mixture comparison results are currently being written up for a separate manuscript.

Its clear that the main effect on soil function, in this initial phase, is the land-use change to grassland rather than due to the effect of grazing animals. However, this statement cannot be confirmed accurately as there were no, as far as I understood, non-grazed paddocks present in this trial.

Authors Reply: We do not entirely agree with this statement. See our reply to reviewer #1's first comment, where we cite work from the University of Wisconsin and their short term MiG soils research.

I am wondering if authors could make a clearer statement about the grazing yields and the differences between the mixtures in the results & discussion chapter. I guess due to the long-arable crop phase as pre-management and the extensive nitrogen application

there are low biomass yields in comparison to other irrigated and well fertilized pastures leading into a reduction of plant residues, which in turn reduces the assumed carbon sequestration rate. This fact was maybe additionally triggered by the poor forage legume establishment even though high soil pH-values should allow favorable growing conditions.

Authors Reply: The forage mixture comparison results are currently being written up for a separate manuscript.

In addition, there are only a few information about the dairy herd available (e.g. breed) particularly with regards to the feeding strategy (e.g. supplements) and consequently about the potential nutrient excretion of grazing cattle, which make results of chemical soil properties hard to explain.

Authors Reply: The breeds (Angus and Hereford) were presented in the original manuscript on line 175 (now line 186 in the revised manuscript). Other than that, the way the herd was managed and their feeding strategy throughout the in-field seasons, within the MiG system was outlined within the M+M section.

Specific comments

Line 126: Mean of what? Monthly I guess

Authors Reply: Correct, monthly. We made the change to the manuscript for clarity.

Line 251: that you used RStudio is not relevant in this context.

Authors Reply: We did not make a change to the manuscript, as we (and others) typically state the statistical software packages used in our statistics section of our manuscripts. Our graduate student performed this work, but when I run stats I use SAS version 9.4 and always cite it in this type of section.

Line 251: as this is not a classical experimental design I am wonder if repeated measurements should be considered in your model.

Authors Reply: We consulted our on-campus statistician for guidance and the designed we used was suggested by him.

Line 262: seems to be very heterogenic. Give SD or SE.#

Authors Reply: What was stated on this line were the minimum and maximum bulk density values, so it is impossible to provide an SD or SE for a minimum and maximum value.

Line 328: You explained that bulk densities increased. Even when this was observed with a high variation, soil carbon stocks in turn should be higher, if C content remained constant?!

Authors Reply: The reviewer is likely correct, but our data suggests that no change in SOC has occurred. . ...yet. In our manuscript, we do elude to the fact that increased beta-glucosidase activity could be an early indicator of other biological changes (Bandick and Dick, 1999) and likely would lead to increased SOC in the future.

Table2 and 3: Table 2 is for me personally more helpful as the used index. Actually, I have my doubts about the benefits of this used index to understand the presented results.

Authors Reply: We can see how table 2 would be preferred by most soil scientists (and others) who will read this manuscript. Why? Because you can see the actual change in soil indicators over time and depth. The Soil Management Assessment Framework takes the data from Table 2, in conjunction with other soil variables such as soil series, texture, clay content, climatic conditions, and uses preset algorithmic functions (based on more is better, less is better, somewhere in the middle is better concepts) to assign unitless scores from 0 (worst) to 1 (best), with the unitless scores shown in Table 3. For others that would want to follow a similar approach in the future with MiG (or other systems), we feel it is important to show the indictor score outcomes from the SMAF for individual indicators. It really helps tie the entire p

Please also note the supplement to this comment:
https://www.soil-discuss.net/soil-2019-91/soil-2019-91-AC2-supplement.pdf

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