

Reaction to reviewers comments on SOIL-EGUSPHERE-2022-307.

Reviewer 1 (Van Looy).

1. The reviewer expresses a valid concern about procedures being a bit narrow and not producing relevant results in a reasonable period of time. He feels that specific targets for specific conditions might work better. I feel that time is short with deadlines for the SDGs at the year 2030 and that the general scheme proposed will provide a general platform to start from. This can provide answers based on general principles. Of course, it can be expanded upon for specific conditions but to start right away with specific targets and specific conditions would most probably result in a wide array of activities without general focus. But the concern of van Looy is valid and a sentence has been added to express his concern (lines 69-77).
2. I certainly agree with the reviewer that we need Lighthouses right away (see lines 75-77, 99-100). And, indeed, not only reaching all thresholds is important (establishing a Lighthouse) but also movement in the right direction should be acknowledged. As the reviewer points out correctly, increasing the organic matter content of soils may take decades. The proposed :”one-out/all-out”system for indicator thresholds, allows a focus on ecosystem services that have not yet met their threshold, allowing a focus for continuing research. At the same time I agree that if management is introduced that will likely have effect in time, this should be acknowledged. I have added text to express this important aspect for future regulations (lines 154-157, 465-469). Thanks!
3. Ecosystem services (es) can be measured or modeled, as demonstrated in the case study that was initiated to show that much can already be done with existing methods and expertise. I would agree with the reviewer that discussions on definitions and methods can, and often will, go on forever. We cannot afford that as a profession at this point in time. Specifically, Yw can be determined as the reviewer acknowledges. But water quality can be measured and thresholds are defined in regulations. The case study points out that models are available to estimate greenhouse gas emissions. This was not yet done in the LL of the case study. Soil health (positive as illustrated) stands for soil degradation. The only problem is biodiversity both at ecosystem and soil level. Ecologists and soil biologists still argue about indicators and thresholds. For soils we did not accept the fact that soil health would be negative because of lack of a soil biology indicator, so we defined a proxy. Most important is the fact that a LL will be judged by es indicators. Subsidies will be based on that (and not on soil health). Soils cannot do it alone as is pointed out clearly in the article. There is no option to operate separately from the ecosystem approach: *soils contribute to...*
4. The agricultural focus was chosen because of limited space but other forms of land use are equally important (lines 59-62).

Reviewer 2. Finke.

1. Whether or not the paper fits in SOIL is up to the editor but I would feel that : *understanding the soil system*”and *“interaction with humans”* as well as:”*emphasis on studies that integrate soil science with other sciences”* are key issues in this particular paper.
2. Former line 62: Yes, more detail on selecting threshold values. Text has been extended (new lines 69-77).
3. Former line 102: ill-informed is omitted. Indeed, there is enough information but not always in an accessible form for (confused)farmers. Now line 129.
4. “Apparently” removed.
5. Line 119 (old). I removed “conficting” and just mention “information”. The issue is now broader discussed in the new lines 149-156. I added an example of biological farming where there is emphasis on not applying agrochemicals but how about the ecosystem services? This is touchy material but the key message is to assess systems by a set of quantitative indicators/thresholds, independant from ideological viewpoints (new lines 145-155). At this time it is not possible, in my view, to present a table relating various farming systems to ecosystem services, also because there will be differences within a given farming system. When there is a suffuicient number of LL’s in future such a table would be very welcome.
6. Line 144 (old) “that may result in Lighthouses”. (line 178). Thanks.
7. Line 160 (old). I see the LL focus to be on farms, if only to really engage the farmer. If pollutants move beyond farm territory the LL ecosystem services for soil pollution should be negative and this would invite and justify further regional analysis.
8. Line 179 (old) good suggestion. Thanks. Reference included. (line 217-221) . I do mention the risk of :”the tragedy of the commons” where individual farmers try to avoid responbsibility by counting on their neighbours to perform.
9. Line 186 (old) yes, market conditions, part of the entire value chain. are important and also require transdisciplinary research. I do not elaborate to not diverge more.
- 10.Line 188 (old) sentence removed.
- 11.Line 200 (Old) the SDGs apply worldwide, also in Australia. I did include a short paragraph on soil security that seems to fit quite well with the SDG discours (lines 120-127).
- 12.Line273-280 (Old). Important point. New sentence lines 321-331. I have seen too many discussions where all parties were present, resulting in chaos. Lees articulate farmers being overwhelmed by talkative ecofreaks. After all, our governments have approved the SDGs. Now farmers and scientists should get going and communicate results widely later while being open to positive criticism (the “larger WE of line 334). The latter is important. The reviewer is quite correct in stating that the level of thresholds is very important. I have stressed in the paper that more research is needed on this issue which is so far largely ignored. A sentence was added to conclusion 4. That is all what is realistically possible at this time, I feel.

Reviewer 3. Rossiter

Good to read that the paper is provocative and interesting. An attempt has been made to structure the paper by having separate sections for farmers, research, the public and policy. This involved already some arbitrary choices as to which topics to cover where. I have again taken a serious look at the layout of the paper and find it difficult to introduce changes in the overall setup, as every move has its own not always favorable consequences. As the other reviewers did not mention this aspect, I suggest we leave the arrangement as is even though I realize that having to read a paper several times is not ideal. Hopefully the paper is so interesting that the reader is willing to do so.

1. The text has been checked and corrected where needed.
2. I have added a reference to the picture gallery for the SDGs that has widely been shown, including short texts for the various SDGs.
3. Line 198 (old). I have added a sentence referring to the type of articles we see. (lines 239-240)
4. Line 203 (old): Thanks for the suggestion! Falconi et al reference is added.
5. Line 210 +: This text is more a reflection on the 5% versus “the truth” issue. I very much agree with this and see it as support for raising this issue in this paper
6. Line 307 (old) “They can best be ignored”. I fear they will not understand the logic nor do they try.
7. Line 472 (old) I have added the website to the quote. Thanks.