

# ***Interactive comment on “Refining physical aspects of soil quality and soil health when exploring the effects of soil degradation and climate change on biomass production: an Italian case study” by Antonello Bonfante et al.***

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(1) General comments

I very much like the concept of this paper and I think it is a solid step forward in our ability to assess the quality and health of soils worldwide. I especially appreciate the effort to include climate and climate change within a soil health framework. Climate data are critical to development of a universal system of soil health assessment because the spatial and temporal interactions between climate and soil physical properties strongly

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influence soil biomass production and other measures of soil health.

The use of dynamic physical and plant growth models based on pedotransfer functions is a powerful tool for assessing soil health over large areas, and is essential for predicting the effects of a changing climate on soil health and yields.

I strongly agree with the authors that the physical, chemical, and biological aspects of soil health need to be assessed in an interconnected, holistic fashion, rather than as separate indicators, as there are many potential interactions among them. For example, the biomass yield for soils with moderate salinity may be more strongly impacted by a decrease in precipitation than non-saline soils of similar textures because plant available water would decrease due both to a decrease in precipitation inputs and higher osmotic pressures resulting from a lower dilution of salts present in the solum. I don't believe these types of interactions can be captured by independent Indicators.

## (2) Specific comments

L 265: "A given soil classification should not change following plowing or other management measures as long as this does, of course, not result in removal of soil or in invasive anthropic activity." This may or may not be true - the classification of some soils (e.g. shallow Spodosols, thin soils in arid or semi-arid climates) may change following plowing due to complete disruption and mixing of the near surface horizons. The use of deeper tillage instruments has expanded this problem to include soils with thicker sola.

L 295: "The effects of climate change are most pronounced and quite clear for the two periods after 2040." Since most readers are not necessarily familiar with the RCP 8.5 scenario, I believe it would benefit the reader to briefly summarize predicted changes in temperature, precipitation, and possibly PET associated with the RCP 8.5 scenario for this portion of Italy in more detail before describing the results of your own modeling efforts.

L 16-18 and Figs. 4, 5, and 6: The definitions of potential yield ( $Y_p$ ) given in these two locations differs somewhat. The definition provided in the abstract is hypothetical and does not rely on soil properties, whereas the one given in the captions states that it is "... calculated over all soil series under reference soil conditions." These two definitions should be rectified. Fig. 2: Since changes in climate are used to calculate the water-limited yields ( $Y_w$ ) in Figure 2, shouldn't the potential yield ( $Y_p$ ) be adjusted to account for changes in climate? If not, then it should be labeled as  $Y_p$  (reference climate).

Fig. 3 - It is not clear what the small open circles above the distributions for RC, 2010-2040, and 2040-2070 are. The caption should indicate what these circles represent.

Fig. 7 - this figure is not very clear to me and could be improved.

### (3) Technical Corrections

L 187: should for "shlould"

L 243: from instead of form.

L 316 and 317: scenarios rather than "scenario's"

L 370: Tillage practices, crop rotations, or poor handling of pests and diseases...

L 374: biological, not "iological"

Overall this manuscript could be improved by additional English language editing.

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