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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.

Antonello Bonfante et al.

antonello.bonfante@gmail.com

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We thank reviewer D.G.Rossiter for his positive comments on our paper. He considers the paper to be technically sound and a welcome step towards quantifying "soil health"and "soil quality". He supports the use of the phenoform concept to show that a given soil type can act differently as a function of past and current management and he also supports the use of dynamic simulation models to characterize the soil-water-plant-atmosphere system in the context of soil quality and soil health studies. . He raises a question about the :"logical and interconnected sequence considering pedo-

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Discussion paper

logical, physical, chemical and biological aspects". Indeed, this issue does not relate directly to the study on soil physical aspects as presented in this paper. It was added to avoid the impression that soil physical aspects would be a quite seperate entity, next to seperate chemical and biological aspects. This is, in fact, is implicitly suggested in the Cornell procedure where three separate indicators are multiplied. Physical conditions are obviously related to soil moisture regimes in a landscape context, requiring a pedological analysis, and soil chemical conditions are, in turn, related to the physical processes while biological conditions react to both. Physically based models of the soil-water-plant-atmosphere system, as applied in this study, can define conditions that are important for chemical and biological aspects involved in the concept of soil health. For example, the activity of microrganisms involved in the mineralization process of organic matter as well as in the nitrification cycle, is dependent on soil responses (e.g. soil nutrients, moisture status and, soil temperature) and on environmental driving forces (upper and bottom boundaries of the soil-water-plant-atmosphere system). With models it is possible to describe soil behaviour and the resulting enviromental conditions for microorganisms. This allows a distinction between different soils. However, in this paper only the potential for a joint rather than a seperate approach to physical, chemical and biological soil conditions is suggested . As attention in the paper is confined to soil physical conditions, relations with chemical and biological conditions are not further explored but we will explain more clearly in the revised paper (based on text in lines 372-377) the connections between physical, chemical and biological soil processes. This comment also relates to conclusion 3 (lines 385-387). Your specific comments and technical corrections have been noted and the next version of the paper will include your welcome suggestions, for which we are grateful. Some of your comments require a reaction: Line 91: Yes, the soil series concept should be better explained in terms of the lowest level of also other classification systems. Line 182: Yes, when water is always available Yp can be equal to Yw but this is unusual. Line 200: we will emphasize the phenoforms. Line 255: The terminology "environmental sytems" will be changed in "landform classes". L391-2: Correct. Though true, this iss not covered in

the paper and we will omit this conclusion. Figure2 The error bars in Figures 2 and 3 explain the uncertainty, it was derived by the simulation of each year of the specific time period (e.g. 30 years). Moreover, we will specify in line 280 that future climate scenarios have been discussed dividing the whole period in three time windows (2010-2040; 2040-2070 and 2070-2100). The caption will be improved. Figure 3. We decide to report the behaviour of rainfall conditions in terms of variability during the reference period. This is important to show that the reference period and the 2010-2040 period are not so different.

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