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Exploring field methods for the assessment of soil condition and soil function in order to estimate ecosystem service and natural capital value across organic and conventional field sites

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It is widely recognised that the intensification of agriculture has had significant impacts on soil condition and function, negatively affecting soil structure, fertility and biological diversity**.** Such impacts have contributed to reduced soil carbon storage, hydrological function, the storage of nutrients, the filtration of pollutants and potential crop productivity. It is therefore important that agricultural systems adapt to ensure the provision of food alongside multiple other critical ecosystem services (ES). Developing our understanding of how to quantify soil function in a given state is important in calculating the value of soil ES and natural capital (NC) under different management scenarios. It is critical for both the establishment of cost effective agri-environment policies and in driving sustainable on-farm decision making at management appropriate scales.

This study aims to examine how field methods, used for the assessment of soil condition and function, can be applied to determine (i) How baseline soil condition measurements relate to soil function across organic and conventional field sites and (ii) Whether enhanced soil function is observed in agricultural soils under organic agriculture and if so, whether the potential economic benefits could offset the loss in crop productivity.

The study was conducted at Clinton Devon Estate in South West England. Nine conventional and nine organic fields, reflecting the main rotational land uses on the estate, were selected. Baseline soil samples were collected from each field in winter 2018 for the analysis of; total carbon (TC), total nitrogen, plant available phosphorus, soil texture, pH and bulk density (BD). Land management data was collected from the farmers for each field. Four soil functions/services were selected for monitoring; nutrient filtering and retention, soil organic matter decomposition, carbon storage and crop production. Crop yields for maize, cereals and grass silage were collected from each of the soil sampled points immediately ahead of harvest in 2019. BD and TC from each sample were used to estimate carbon storage. Three sites from each field were selected for the assessment of soil organic matter decomposition using the standardised and globally applied Tea

Bag Index method (Keuskamp et al., 2013). A smaller sub-set of six fields (three organic and three conventional) were selected for the determination of nutrient filtering and retention. Porous pots, ten replicates per field site, were installed below crop rooting depths in October 2018 for monitoring through the 2018 – 2019 and 2019 – 2020 drainage seasons. A sample of soil pore water was extracted (fortnightly) and analysed for nitrate, nitrite, ammonia and phosphate, allowing a comparison of nutrient leaching between sites.

The data from this study will be presented for the assessment of whether quantification of soil functions at the field scale can help in the identification of useful baseline indicators and contribute to the valuation of soil ES and NC.

References:

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