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House of Commons Environment, Food and Rural Affairs Committee: Soil Health

Submission by Applied Microbiology International

How can the Government measure progress towards its goal of making all soils sustainably managed by 2030? What are the challenges in gathering data to measure soil health how can these barriers be overcome?

The UN Agency's Intergovernmental Technical Group on Soils (ITPS) defines healthy soil as 'the ability to sustain productivity, diversity and environmental services of terrestrial ecosystems'[1]. 'Microbiome' relates to the community of microorganisms (for example bacteria, fungi, protozoa and viruses) found in a particular environment[2]. It has been shown that soil microbiomes (aka the communities of microorganisms within soil) vary taxonomically between regions[3], making direct comparisons difficult. The focus should therefore be on comparing soil functions rather than taxonomy, in order to measure soil health.

It is worth considering the appropriateness of having a broad/generic metric (e.g., total soil organic matter content) to compare soils, which would provide a simple message for producers and policymakers. Organic matter content could be measured and reported by producers with incentives provided for reporting and for improvements. Sub-targets could also be used covering areas such as sustainable crop rotation[4] and minimising soil compaction, however these would be harder to measure.

There must be an understanding that measurements of soil health are context specific, and that their utility is greatly improved if measurements are considered as relative changes over time, rather than absolute numbers at a single point in time. This will allow land managers to be judged on whether their land management practises improve, maintain or reduce soil health.

It is also important to understand that we simply do not have a good handle on the range associated with many parameters as they pertain to soil heath. This requires a concerted effort to understand how management interacts with basic soil properties such as texture. Unless we have a better understanding of the term 'soil health', it will be difficult to provide meaningful measurements.

The USDA has provided some information that the UK could develop for UK practice[5]. They define soil health as 'the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals and humans'. They have also developed four principles for managing soil health, and a soil health assessment[6].

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[1] https://resoilfoundation.org/en/environment/healthy-soil-official-definition/
[2] https://www.genome.gov/genetics-glossary/Microbiome
[3] https://www.osti.gov/pages/servlets/purl/1615017
[4] https://www.csuchico.edu/regenerativeagriculture/ra101-section/crop-rotation.shtml
[5] https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health
[6] https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health/soil-health-assessment

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Do current regulations ensure that all landowners/land managers maintain and/or improve soil health? If not, how should they be improved?

While the interest in soil health continues to grow, much regulation focuses on prevention of pollution rather than directly improving soil health, however it would be difficult to form regulations on the latter when it's still unclear how soil health should be measured. Clearer definitions and goals around soil health would be necessary before regulations on improving soil health could be put in place.

Will the standards under Environmental Land Management schemes have sufficient ambition and flexibility to restore soils across different types of agricultural land? What are the threats and opportunities for soil health as ELMs are introduced?

No, the standards under ELM schemes are not sufficiently ambitious or flexible. The sustainable farming incentive within the ELM focuses on macro scale, yet there are knowledge gaps regarding soil and plant microbiomes which need to be acknowledged to better inform what threats and opportunities there are. These are:

- The biggest knowledge gap is in being able to give good guidelines to farmers on what soil health indicators mean in their situation, i.e., whilst generic recommendations are useful, context-specific recommendations would be favourable.
- The role of and impact on soil and plant microbiomes following changes to land use that involve biodiversity changes, i.e. 'local nature recovery'.
- Soil acts as a buffer to a certain extent (for environmental hazards / climatic changes) yet there is a knowledge gap on the longer-term effects and resilience of the soil microbiome to these changes.

There is a good opportunity for the UK to really embrace and fully utilise its natural capital including microorganisms e.g. encourage arbuscular mycorrhizal fungi (AMF) or other endophytes as biofertilizers. Biofertilizers are microorganisms that naturally increase plant nutrition[7].

What changes do we need to see in the wider food and agriculture sector to encourage better soil management and how can the Government support this transition?

- Circularity in production systems e.g. in supplementing soil carbon, but this requires oversight and strong guidance / protocols to help ensure safety from microbial hazards (including AMR).
- Land use planning e.g., why produce soft fruit in polytunnels on good agricultural land when this could take place on brownfield sites. Also preventing loss of good agricultural land to urban development.
- Increasing biodiversity, including microbial biodiversity (which is often ignored), since they are crucial in nutrient cycling and tackling pollutants.

[7] https://doi.org/10.3389/fsufs.2021.606815

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What does UK Government need to do to tackle other stressors on soil health such as soil contamination?

- Further research on soil health.
- An incentive to encourage sustainable bioremediation (e.g., phytoremediation and vermiremediation), and solutions that may also bring additional benefit such as carbon sequestration (e.g., use of biochar). Bioremediation is a process that largely uses microorganisms or plants to detoxify contaminants in soil[8]. Phytoremediation refers to using plants and vermiremediation earthworms / microorganisms to decontaminate soil.
- Expand the utility of Soil Health indicators, as per the AHDB Great Soils projects: these have a proven record and provide an excellent point for expansion and development.
- Invest in long-term cropping platforms to de-risk 'trial & error' for primary producers, and instead provide robust platforms that are used for the experimental research and for knowledge exchange.
- Enable more floodplain development and rewilding to increase resilience to drought and flooding cycles; this will help prevent soil from being exposed to these stressors which are likely to increase with climate change.

About Applied Microbiology International

Applied Microbiology International is solving some of the world's greatest challenges by bringing the applied microbiology community together, across borders and disciplines, to enable meaningful collaboration that delivers scientific impact. With a strong focus on influencing international policy, we are organised around seven core UN Sustainable Development Goals and encourage partnership between academia and industry to increase our impact.

Word count: 1030

[8] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bioremediation