



ALL PARTY PARLIAMENTARY GROUP

# Agroecology for Sustainable Food and Farming

BRIEFING PAPER

## SOIL TESTING AND DATA COLLECTION

APPG on Agroecology for Sustainable Food and Farming:  
Inquiry into soil health



## APPG on Agroecology for Sustainable Food and Farming: Inquiry into soil health

The APPG on Agroecology for Sustainable Food and Farming conducted an inquiry into soil health and protection in 2015/16, with a particular focus on agriculture. Evidence was heard across three oral evidence sessions from the following expert witnesses:

**Martin Rodgers** (*National Farmers Union*)  
**Peter Melchett** (*Soil Association*)  
**Prof. Andy Whitmore** (*Rothamsted Research*)  
**Lord Deben** (*Committee on Climate Change*)  
**Robert Askew** (*land classification specialist*)  
**Prof. Steve McGrath** (*Rothamsted Research*)  
**Georgina McAllister** (*GardenAfrica*)  
**Vicki Hird** (*War on Want*)  
**Prof. Mark Kibblewhite** (*Emeritus professor, Cranfield University*)

Scheduled to appear but unable to on the day, the following also gave input to the inquiry:

**Graham Harvey** (*Agricultural journalist, author of *The Carbon Fields**)  
**Prof. Tim Wheeler** (*Department for International Development*)

The inquiry panel was drawn from members of the APPG and included the following who put questions to the witnesses:

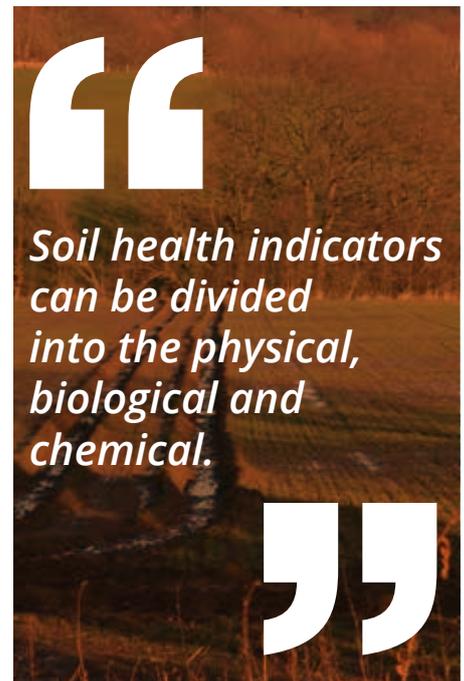
**Scott Mann MP**  
**Simon Hoare MP**  
**Jeremy Lefroy MP**  
**Rebecca Pow MP**  
**Daniel Zeichner MP**  
**Baroness Miller of Chilthorne Domer**  
**Baroness Young of Old Scone**  
**Lord Cameron of Dillington**

The report below is based on the evidence heard during the inquiry as well as additional information provided to the panel.

### WHAT IS HEALTHY SOIL AND WHY SHOULD IT BE MEASURED?

Soil degradation has negative consequences for both farmers and the wider public, as explained by Professor Kibblewhite and others. Farmers and land managers require clear evidence of the effectiveness of changes in management practice.<sup>1</sup> At the same time the effects of soil degradation on the climate, environment and public purse all need to be quantified if possible. Testing and measuring soil condition, quality and change is therefore a key part of improving soil health and encouraging better management.

Unfortunately there is no single clear definition of a health soil, largely because soil performs a great many functions and varies a great deal from place to place. As a result one definition of soil health is the ability of soil to perform the functions required of it. Despite this lack of agreement it is generally accepted that measuring changes in the soil is a necessary to attempt to improve it, either at the local or national level.



## SOIL TESTING FOR FARMERS AND LAND USERS

Soil health indicators can be divided into the physical, biological and chemical. All are important and all interact. So for example the chemical makeup of the soil affects both the biological activity and the physical status of the soil (e.g. soils high in magnesium become easily compacted).

One way of determining land quality is through the agricultural land classification which is based on an analysis of the suitability of the land for growing crops and used as a guide in planning and development. The land classification is largely based on permanent characteristics of the land such as soil type or topography. In contrast, soil condition is a measure of how close the soil is to achieving optimal potential given the original quality of the soil. This condition can change more rapidly, through poor land management causing soil erosion or loss of fertility, or improved through addition of fertilisers or organic matter. It is this condition of the soil which most tests aim to measure.

There are many different ways to test the soil depending on what is being measured and how easy it is to measure it. Physical indicators are perhaps the easiest to test on site through visual tests. Digging holes or pits and examining the soil can give an indication of its structure and how compacted it is. More sophisticated tests, such as of soil density, can give a more accurate indication of compaction levels. An awareness of the basic physical structure of the soil can give a basic overview of where there are problems such as waterlogging or erosion.

Chemical indicators such as the levels of macronutrients (nitrogen, phosphorus and potassium), the pH and more detailed analysis of trace elements largely need to be done in a laboratory, though basic chemical analysis is reasonably cheap and accessible. Basic chemical information is useful for determining fertiliser strategies and is often used as the justification for fertiliser use and levels. Greater detail is usually only sought in response to specific problems, where a chemical deficiency is suspected.

Witnesses led us to the conclusion that biological indicators are the hardest to measure but are the most useful. An earthworm count is an easy way to gauge the approximate level of biological activity – the more earthworms the more likely there are to be additional micro-organisms in the soil. Earthworm counts also give an overview of the likely biological activity of the soil. Another indicator of biological activity in soil is the soil organic matter (SOM) content, which can be tested in a laboratory. The results can reveal how much organic matter is in the soil and give an indication of how much it can be increased (showing the proportions of SOM that are stable or inert and therefore unlikely to quickly decompose and be available to micro-organisms). More sophisticated testing can also include biological indicators such as micro-organism activity.

## HOW CAN SOIL TESTING BENEFIT FARMERS?

Cross-compliance rules within the Common Agricultural Policy require a soil risk assessment of the farm and creation of a soil management plan. This involves identifying areas of highest risk and tend to concentrate on the most obvious physical factors (signs of erosion, flooding, compaction or waterlogging for example). These measures were described in evidence to the APPG by both Lord Deben and the Soil Association as the bare minimum, and better than nothing. But they were also criticised for the many damaging practices



that they do still permit, for example they allow leaving maize stubble over winter to avoid bare soils, something which both the Maize Growers Association and AHDB (The Agricultural & Horticultural Development Board) advise against as an inadequate management to prevent erosion.<sup>2</sup>

Measuring and monitoring are necessary (though not sufficient) as guides to improving farm management and practices. Some testing will readily lend itself to practical land management options, such as a macronutrient deficiency which can be remedied by adding fertiliser. Others, such as low SOM content, can take decades of interventions before a change is noticed.

The NFU emphasised that testing needs to be carried out consistently and rigorously to be of benefit, for example ensuring that samples are taken from the same place when measuring change. Visual tests can give a good indication of soil quality, including evaluating plant health as a proxy for soil quality. Simple tools, such as charts against which to compare soil samples visually, can increase the utility of visual tests. Even when sophisticated chemical or biological tests are used, these should be combined with visual checks, such as pit digging, so that farmers increase their overall awareness of the health of their soils.

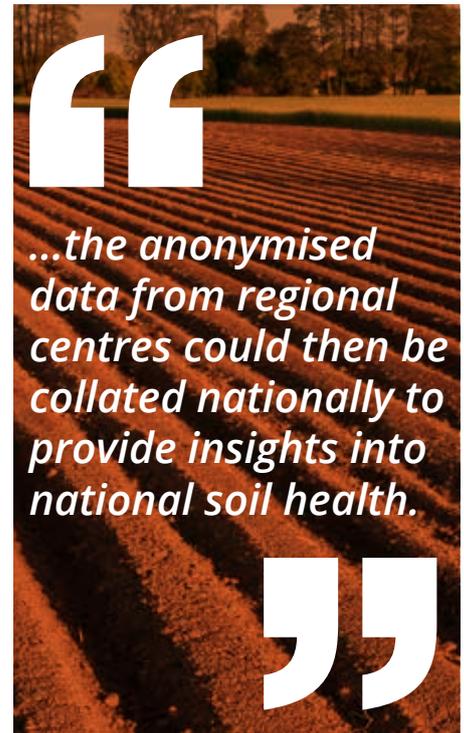
The Soil Association explained that techniques to increase SOM are not complicated or controversial, relying on practices that hold nitrogen in the soil (e.g. cover crops grown over winter which are then incorporated back into the soil or the use of plants with denser or deeper roots). The barrier to carrying out these practices is more financial, with a lack of incentives for farmers to take action to improve their soil quality in the long term, even if they are aware of soil deficiencies.

There are such incentives out there, including the organic regulations and market, which encourage precisely the sorts of activity likely to improve soil health. Other interventions include the possibility of requiring soil testing at the beginning and end of agricultural tenancies, along with requirements for the soil to be kept in as good condition as it was at the start of the tenancy. This is something the Crown Estates are piloting, and could be expanded if dilapidation covenants in tenancies for soil degradation were included.

## HOW COULD REGIONAL/NATIONAL SOIL DATA BE GATHERED AND MONITORED. WHAT COULD THIS TELL US – COULD IT DIRECT POLICY?

There are a number of gaps in our knowledge about the soil and changes to it. For example the lack of national surveys looking at soil loss to erosion mean we do not know currently the effects of different land uses and farming practices on soil loss. Similarly there is little availability of evidence on compaction, in part due to the difficulty of measuring it as it occurs at different levels in the soil.

The NFU, in evidence to the APPG, highlighted the problem of monitoring data for the farming industry due to the number of actors involved. So while retail has five or six large players, whose combined data on key indicators would give a good overall picture of the industry, farming consist of thousands of individuals. Gathering data from all of them which can be compared and amalgamated to produce an overall view is much harder. The process is therefore potentially costly, and can take a long time for changes to be recorded.



Professor Kibblewhite cited the example of France, which has an extensive testing regime carried out by the government and so has a good dataset on the country's soil. This would be hard to emulate in the UK, given the unlikelihood of the government being willing or able to undertake such an elaborate and large scale scheme. There are other options, however, one of which, described by Professor Kibblewhite, would be to collate data in a series of regional data centres. Much of the data is already gathered by farmers, using increasingly sophisticated technology, but is not usually shared as it is seen as private. They would use sophisticated analytical tools to extract relevant information which would have utility for farmers in that region (such as comparisons against neighbours). This would act as an incentive for farmers to pay for the data to be collected and analysed. An additional advantage would be that the anonymised data from regional centres could then be collated nationally to provide insights into national soil health. Precedents exist, such as the national biodiversity network, which many farmers feed into.

## POLICY RECOMMENDATIONS

- Create a long term target to increase soil organic matter content at the national level. This target could be set as a national average, so that some soils would need to increase their levels while those such as peat, which already have high organic matter contents, need not be affected or could be the subject of additional targets to increase the average SOM level. This is easy to measure and a positive indicator of soil health. The achievement of this objective would require the adoption of a suite of best practice measures, which would serve to protect and improve soils over the long term.<sup>3</sup>
- Use CAP – Pillar 2 measures to target soil directly and to encourage and financially incentivise farmers to improve soil health by increasing SOM content. One option could be agroforestry, which has the added benefit of diversifying business and so increasing financial stability.
- Soil condition should be captured as part of the asset value of land. This would give a financial incentive for tenants, and possibly owners, to maintain that condition.

<sup>1</sup> See APPG Soil Briefing 2

<sup>2</sup> <http://dairy.ahdb.org.uk/news/technical-articles/october-2015/managing-maize-stubble/#.Vs3dL5OLQdU>

<sup>3</sup> One example of an effective national target is the UK's emissions reduction target, by way of the Climate Change Act 2008, which has received widespread support and brought immediate changes in practice and in policy.



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## Agroecology for Sustainable Food and Farming

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