

Cambridge Zero

Virtual Policy Workshop on Soils

What would an agricultural soil plan for the UK look like and which measures would we use to monitor its effectiveness?

A summary of the discussions held on 20 April 2020

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Scope and summary

This Cambridge Zero virtual Policy Workshop was designed for stakeholders to explore soil in the context of climate change mitigation and adaptation – including carbon sequestration, biodiversity, flood protection and clean water – and what a soil policy for the UK might look like and the measures we could use to monitor its effectiveness.

With the urgent need to tackle climate change and adapt to the impacts of a changing climate in the UK and against the background of Brexit, there are several policy drivers around soils:

- The government's 25 Year Environment Plan states that: '*England's soils must be managed sustainably by 2030*' and that '*steps must be taken towards restoring the UK's soils*' (<https://www.gov.uk/government/publications/state-of-the-environment/summary-state-of-the-environment-soil>).
- The 25 Year Environment Plan requires appropriate soil metrics and management practices in order to improve our approach to soil management. As part of this, a 'Healthy Soils' indicator is being developed as part of the 25 Year Environment Plan Outcomes Indicator Framework.
- The Environmental Land Management (ELM) scheme will replace the EU's Common Agricultural Policy and is set to be rolled out by the end of 2024. Policy decisions around what advice to provide farmers, how to incentivise farmers to act accordingly, how to measure and monitor healthy soils will need to be taken.

Throughout this discussion, participants explored the current state of soil management and how the aims of soil management can vary according to what a specific area is best able to deliver. Participants explored the metrics used to determine soil health; how these metrics are and should be applied in land management; and the instruments and innovations being developed to deliver soil protection and management.

The current state

The current state of soil policy

Soil is an ecosystem that underpins benefits ranging from biodiversity, food production, carbon storage and natural recovery to flood protection. However, it cannot perform these functions well when degraded, compacted, eroded, or when it has lost organic matter.

To manage the future of our soils, the government introduced a 25 Year Environment Plan which aims for sustainably managed soils by 2030. The Environment Bill 2020 has set out legally binding environmental targets, and incentives for soil health are also included in the Agriculture Bill. Accompanying land management schemes will reward participants for environmental benefits they provide, and government is also in the early stage of developing a national soil health monitoring scheme. Policy makers are also aware of the impact of land use and management choices on existing soil carbon sinks and reservoirs, of the potential for soil carbon sequestration in the agriculture sector, and of the potential impacts of climate change upon soils. Here, monitoring and data collection will prove vital, while exploring the wider systems of soil structure and function may prove to be a useful frame.

The science underpinning soils

Scientists use several different soil health indicators, including biological indicators such as earthworm density, chemical indicators, carbon content, pH levels, nutrient availability, urban soil contamination, and physical indicators such as bulk density and infiltration rates. More recently, there have been huge advances in DNA sequencing technology, which is likely to be used as a soil health indicator in the future. As a participant noted: “even though we have this basket of indicators, we don’t know which ones to use at a particular point in the landscape”. Consequently, the participant suggested that managing the science underpinning soil requires a two-pronged approach involving both a broad look at the state of our environment and accompanying sampling schemes. The biggest challenge is to establish a soil health indicator framework which is dynamic enough to account for different factors in diverse landscapes and land management strategies. For example, it was noted that indicators for urban soils might not be relevant to agricultural soils.

It was suggested that the UK needs to improve its carbon stocks, as carbon, especially in agricultural soils, is presently degrading across the UK’s soils. It was suggested that improving soil carbon sequestration comes with secondary benefits, such as improving the nutrition, water holding capacity, and biological diversity of soils.

Farming and soil health

Participants noted the seven policy asks of the NFU around soils:¹

1. Include soil health management options in future agriculture support and environmental land management schemes
2. Improve and expand knowledge exchange initiatives
3. Increase investment in soil research and innovation, with the goal of understanding how changing management practices such as reduced tillage has an impact on the physical, chemical, and biological health of our soils.
4. Generate more reliable and robust data on soil, collected using new technologies, to help farmers make informed management decisions.
5. Development long-term collaborative approaches for managing peatlands, with a focus on sustainability, the needs of farmers, and local management
6. Increase financial support for market approaches which improve soil health and increase carbon storage
7. Avoid a one-size fits all approach to soil health

Soil and conservancy

It was argued that metrics for measuring the quality of soil depend on the soil in question. For example, impoverished soils which are not useful for agriculture or carbon sequestration may still have plant and animal communities which are dependent on the continuing of that form of soil composition. These dynamics need to be considered during the process of soil mapping, as does the degree of complexity and difference in soil composition even on very small scales such as allotments.

¹ <https://www.nfuonline.com/cross-sector/environment/soil/nfu-policy-asks-on-soils/>

Consequently, it was suggested that we must “strive for some way of working out the optimum value of different soils and then to be planning that into an overall approach, which then we can incentivise with tools including land use planning and conservation efforts.”

In the case of soil carbon, peatlands management is vital not only for preserving biodiversity but also for carbon sequestration and reducing flood risk. Finding ways to store carbon in other soil types needs to be accompanied by efforts to avoid manufactured fertilisers such as ammonium nitrate.

Soil indicators

What metrics should be used to measure soil health? What challenges face those seeking to apply measures of soil health in land management?

Participants noted that there are many guidance documents on soil health metrics and that the use of different terminologies and competing sets of guidance risks introducing a high level of confusion concerning where and when to apply specific soil health indicators. Consequently, it was suggested that there is a critical need for simplified, applicable tools in environmental land management which can address the application of soil health metrics to different soils, geographies, functions, and purposes. Some participants suggested that the measurement of soil characteristics should act as a function of location-specific soil management objectives, and highlighted the strong links between land use planning, our understanding of ecosystems, and soil management.

It was also noted that the extent of academic work and understanding concerning soil management is variable. There is a good standard of comprehension when it comes to soils used for agriculture production, but this understanding tends to decrease as the economic value of the soil type reduces.

In the case of soil used for food production, scientific metrics for soil management include nutrient values, bulk density, and porosity. Other discussed soil metrics included pH levels, carbon sequestration, and DNA measures. There has also been a lot of work done on minimum (or reduced) tillage in the context of arable agriculture, which some suggested was a key principle of any guidance on regenerative soil management, alongside increasing organic matter inputs and increasing diversity in rotations. It was also noted that some crops, such as potatoes, are grown on more vulnerable soils, and that metrics for soil health here could differ from those used for other crop varieties.

It was suggested that the simplest metric for soil management is whether ‘land is able to deliver its function’ while remaining healthy. In practice, this means understanding what we are trying to achieve from the land – whether it is farming, peatland restoration etc. – and understanding that there may be tensions and trade-offs in determining primary and secondary functions for land management while trying to farm, support biodiversity, and manage water. Participants stressed the importance of a holistic approach which seeks to derive multiple use benefits from some soils. Other discussion participants highlighted that small differences and trends in soil changes, rather than absolute values, are the most valuable way of understanding the physical and biological properties of the soil and determining whether soil management of that land is headed in the right direction.

Soil carbon

In addition to the focus on soil health metrics and indicators, participants also discussed soil carbon, including both the use of soil carbon as a soil health indicator and the potential for carbon sequestration to become commercialised in a green economy.

Participants suggested that the extent to which soil carbon matter differs depending on the context. advising that carbon itself is not the most important element, and that simply measuring carbon is an “incomplete” strategy. Carbon “will deliver more in some places than others”, and some speakers suggested the need for trade-offs between soil carbon and other benefits, both public and private. Participants also noted that soil properties change through time, meaning that soil carbon rates may change at different rates in different places. Consequently, it was suggested that soil carbon measurement should be accompanied by measurement variables that give an indicator for soil carbon stability.

While highlighting the need to ensure that “other objectives are properly recognised”, some participants also discussed market opportunities for soil carbon capture. Carbon trading was highlighted as an area where private capital could participate in soil management through the creation of broad market mechanisms, including ways of pricing the commodity and ensuring effective farm gate measurement of the carbon footprint in food production. It was also noted that there is consumer demand for responsibly produced products, which has encouraged corporate interest in carbon sequestration and other climate commitments, but that the development of the appropriate market mechanisms needs to also be explored and debated from a public policy angle. It was suggested that the development of an Office for Carbon Removal and the introduction of a Soil Carbon Code would be useful contributions from the policy community. One participant highlighted private sector initiatives which reward farmers for storing carbon in their soils in the United States, including a Boston-based initiative called Indigo, which could act as examples of how to create carbon cost metrics for farmers which could be then fed into the voluntary or compliance sectors, or used as carbon credits.

Establishing strategic objectives

How would we go about establishing the process of deciding which soil metrics to use in which places to achieve which management objectives? What processes should be used to achieve consensus on soil management strategies?

Participants suggested that “we require a spatially explicit soil measurement strategy”, which should address how to operationalise soil health management with the goal of achieving desired primary and secondary soil health management objectives at a large scale. It was noted that success in doing so would require allocating different land parcels to different objectives depending upon the characteristics of the land and the objectives of the land manager. Participants highlighted the need for multi-stakeholder dialogue and public consultation throughout this process. This land management via multi-stakeholder, multi-dimensional frameworks is vital in order to address population level needs for flood risk reduction, timber, the reduction of urban air pollution, spaces for recreation and wellbeing, biodiversity, carbon capture, and food security.

Land use plans

How should soils be integrated into land management practices?

Participants noted that consideration of soils must be integrated into core land management, with multiple people suggesting that we need to incorporate soil metrics into spatial planning first at the county level, where there might be substantial variation in soil type, and then at a national level. These suggestions were accompanied by questions on how fine-grained these land use plans should be, and how to collect the data to inform strategic spatial planning responses. One participant raised the concern that, in terms of multi-jurisdictional views on land management values, further research would be needed prior to the development and implementation of large-scale spatial planning efforts.

A spatial planning framework that is in development through the Nature Recovery Network will be mandated in the Environment Bill and was raised as one possible means of building a picture of which soil priorities are best pursued in different places. Others suggested the need to link soil management and land use schemes with other pre-existing schemes, including the England Peat Strategy, farming information, and the Nature Recovery tree strategy.

It was also suggested that spatial frameworks for soil management and land use should be indicative rather than statutory in order to encourage stakeholder buy-in. Moreover, in implementing land use and soil management plans, some farmers have suggested that longer term tenancy agreements would be a useful step towards ensuring they have the time and resources to finance and implement soil improvements in keeping with the Sustainable Soils Management Plan. Others suggested a due diligence obligation on landowners, which might involve, for example, requiring all prospective tenants to submit a sustainable soil management plan, and ranking tenancy bids not only on rent offered but also on the strength of their soil management plan.

Regulation

How should we manage the regulation of soil management schemes?

One participant noted that there is a “good mix of legislation and voluntary initiatives” in the soil management space. However, other participants raised concerns as to whether there is adequate transparency behind the mechanics and legal liabilities involved in private sector schemes. They noted that there are many ongoing private and public schemes where much remains unknown about how their regulations and guidelines fit together. This includes land use schemes, natural capital planning and nature recovery networks schemes. It was suggested that there may be value in tying schemes together at a local level which would involve linking soil assessment evaluation scheme design and implementation, with the aim of generating local consensus on regulation and planning for soil management which can be tailored to the needs of local areas. Others suggested that regulations should be indicative and should focus on the county-level, noting the need for “a sense of decision making that is bigger than local but smaller than national.”

With respect to national level regulations concerning soil management, including the Agriculture Bill and the Environment Bill, some participants suggested that they “could set much more ambitious targets” and have “much stronger frameworks”. They suggested that there is a need for further dialogue and engagement with parliamentary processes to refine and advance the goals of these pieces of legislation.

Reflecting on present levels of regulatory compliance concerning already-implemented rules, one participant noted that there is presently a low level of awareness about the Farming Rules for Water introduced in 2017. They highlighted the need for further reflection how to best incentivise compliance and asked whether there is an argument for a transitory phase where farmers can be paid to bring their practices up to speed.

Stakeholders

How do we facilitate the conversations and relationships needed to manage soil health?

Participants suggested that we need to “engineer social consensus” around soil management in order to make progress in soil conservation. Participants highlighted the need for land manager buy-in in soil conservation, and the need for a governed dialogue which brings land managers, tenant farmers, landowners, public resource managers, funding agencies and public authorities, including at local and regional levels, into the conversation. One participant highlighted the importance of landowners taking responsibility for the state of their soil, part of which involves helping their tenants and land managers make the right decisions concerning soil health.

Reflecting on ongoing consultation efforts in this space, such as in spatial mapping, one participant emphasised that there are presently issues reaching a diverse set of voices, and that consultations presently tend to be dominated by the same small groups of powerful stakeholders. In response to this, one participant suggested that systematic conservation planning, a multi-stakeholder driven process that uses optimisation algorithms to help achieve objectives, as one possible way of consensus building. Others suggested that we need to make use of existing social capital and program delivery platforms in land management communities, including farmer facilitation funds, farmer clusters, and the frameworks used to deliver catchment sensitive farming.

Soil: public and private goods

Soil as a public good?

There was debate about the extent to which soil should be considered a public good. Underpinning this discussion were explorations of the public and private benefits that arise from soil properties, and questions about who should pay for soil management, and who should be deemed ultimately responsible for good land stewardship. It was noted that Defra views soils as an important natural asset which helps provide public goods.

While some public benefits clearly arise from soil properties, soil also confers private benefits on farmers for which they can gain recompense for the cost of land stewardship through markets. It was agreed that it is important for public policy to identify soil properties which are of benefit to society, but how much governance and public investment should be involved in soil management was disputed. Some participants noted that healthy soil has ramifications for water security, flood risk, and biodiversity, in addition to national food security and crop productivity. This would suggest that there are different types of conservation and public benefit questions involved in the management of land which could necessitate the involvement of different stakeholders who are interested in attaining different benefits out of the management of the soil. Some stakeholders might be interested in short term benefits, while others are interested in long term soil benefits,

meaning the soil management practices which would result in these could be different. For example, those interested in agricultural land management and food production could be interested in short term land management such as the use of inorganic fertilizers which can drive longer term degradation. One participant suggested that bringing these stakeholders together to finance and govern the management of soil might be an area of interest for those working in policy, while another proposed that this could be an argument for viewing soil as a public good.

Case studies

International perspectives

How are other countries managing their soils and delivering policies which aim to improve soil properties?

A few participants highlighted that while some challenges faced in the soil science community are place-based and context-specific, there are still some lessons that could be learned from work happening internationally. Farming institutions and universities around the world can provide case studies of progress in biodiversity, carbon building in the soil, supply chain management, and developing standards for soil indicators. There is also room for farmers from other countries to share best practices concerning tillage conservation agriculture. One participant cited an example of New York farmers sharing watershed management practices with counterparts in Wales, while other participants suggested that there may be lessons to learn from projects on soil metrics at the European Commission's Joint Research Centre, and projects on systematic conservation planning in South Africa and Australia. As a counterpoint, other participants emphasised the place-based nature of successful soil policies, noting that above all, "we need to do what is right by the UK" in our soil policy development.

There were also suggestions that UK soil conservation efforts should be linked to the United Nations Sustainable Development Goals and the Revised World Soil Charter.

UK case studies

What can we learn about best practices in soil management schemes from ongoing projects in the United Kingdom?

Throughout the discussion, participants cited several projects which have the potential to contribute to our understanding of good soil management practices including:

- Work at Cambridgeshire's Hope Farm on future metrics for public goods provision
- A National Farmers' Union [Carbon Calculator Review](#): a program evaluating the sector-specific utility of carbon tools in agriculture
- A National Farmer's Union [Farm Status Indicator](#): a carbon quiz which provides farmers with crude carbon assessments
- Collaborations between UK water companies and farmers on watershed management, including a project focused on reducing the use of slug pellets containing metaldehyde
- Work on soil conservation through farmer discussion groups, conducted in collaboration between WWF-UK and the UK National Network of Farmers
- The development of 'traffic light' soil health scorecards, led by AHDB Soil Biology and the Soil Health Partnership

- Carbon budgeting tools such as the Carbon Cutting Toolkit, ECalc (SRUC) and the Cool Farm Tool

Participants

- **Dame Fiona Reynolds (Chair)**, Master, Emmanuel College, Cambridge
- **Philippa Arnold**, Environment Policy Adviser, National Farmers Union
- **Rachel Boulderstone**, Joint Head of Soils & Peatlands team, Defra
- **Stuart J Clenaghan**, Principal, Respira International Ltd
- **Professor Chris Collins**, Professor of Environmental Chemistry, University of Reading
- **Dr Tony Colman**, Visiting Research Fellow at the Earth Institute, University of Columbia
- **Harriet Cooper**, Senior Policy Adviser, Defra
- **Dr Gemma Cranston**, Acting Director, Natural Resource Security Portfolio, Cambridge Institute for Sustainability Leadership
- **Ellen Fay**, Founder & Executive Director, Sustainable Soils Alliance
- **Dr Rob Field**, Senior Conservation Scientist, RSPB
- **Professor Ian Hodge**, Professor of Rural Economy, Department of Land Economy, University of Cambridge
- **Julius Joel**, Group Product Director, Celery at G's
- **Tony Juniper**, Chair, Natural England
- **Dr Anna Mikis**, Senior Science Adviser, Defra
- **Matthew Orman**, Executive Director, Sustainable Soils Alliance
- **Dr Adam Pellegrini**, University Lecturer, Department of Plant Sciences, University of Cambridge
- **Richard Perkins**, Food, Agriculture and Land Use Specialist, WWF-UK
- **Professor David Powlson**, Lawes Trust Senior Fellow, Rothamsted Research
- **Cairo Robb**, Magdalene College Gardens Department, Cambridge
- **Dr David Rose**, Elizabeth Creak Associate Professor of Agricultural Innovation and Extension, University of Reading
- **Dr Emily Shuckburgh**, Director, Cambridge Zero, University of Cambridge
- **Dr Elizabeth Stockdale**, Head of Farming Systems Research, National Institute of Agricultural Botany
- **Dr Edmund Tanner**, Researcher, Cambridge Conservation Initiative
- **Dr Henry Webber**, Policy Adviser, Defra

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- **Dr Rob Doubleday**, Executive Director, Centre for Science and Policy
- **Kate McNeil**, Communications Coordinator, Centre for Science and Policy
- **Lauren Milden**, Policy Adviser, Centre for Science and Policy
- **Alasdair Neilson**, PhD student, Department of Geography, University of Cambridge